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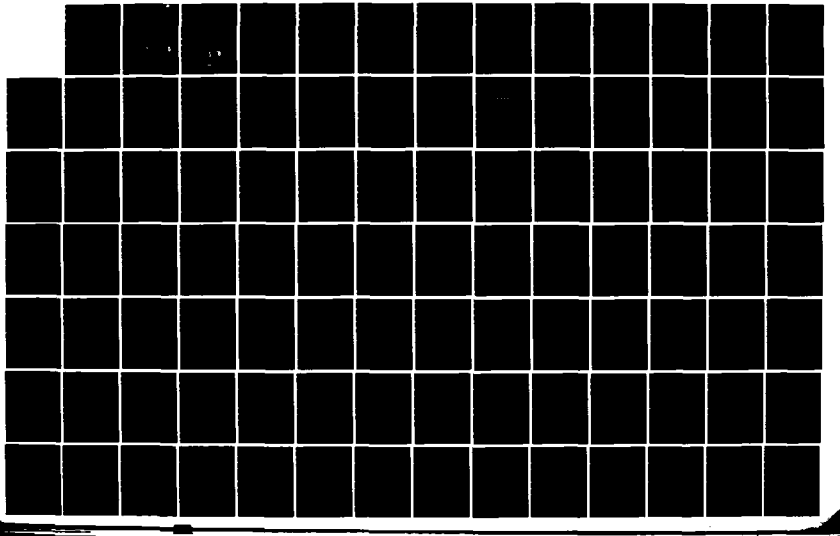

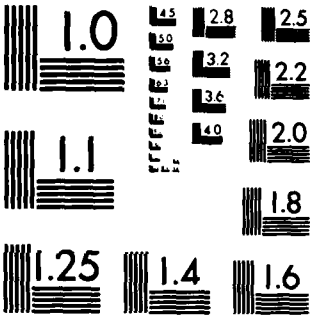

REVIEW OF REPORTS

GEORGETOWN HARBOR
SOUTH CAROLINA

FEASIBILITY REPORT

DEEPENING
AND
EXTENDING CHANNELS
FOR NAVIGATION

U.S. ARMY ENGINEER DISTRICT, CHARLESTON
CORPS OF ENGINEERS
Charleston, South Carolina

JANUARY 1978

FEASIBILITY REPORT

REVIEW OF REPORT

GEORGETOWN HARBOR
SOUTH CAROLINA

DEEPENING AND EXTENDING CHANNELS FOR NAVIGATION

Syllabus

This report presents the engineering, economic and environmental studies conducted to determine the advisability of modifying the existing project in compliance with four Congressional Resolutions, the latest of which was adopted 11 December 1969 by the Committee on Public Works of the United State House of Representatives.

Various solutions to the problems and needs of the Port of Georgetown were analyzed. Based on the results of this analysis, the District Engineer finds that there is no economically-feasible plan for modifying the existing Federal navigation project. The District Engineer, therefore, recommends no plan of improvement as a result of this report.

GEORGETOWN HARBOR,
SOUTH CAROLINA

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The Study And Report

In recent years the Port of Georgetown has become increasingly important to the economic and social well-being of the citizens of Georgetown and the surrounding area. In spite of severe limitations with regard to channel depths (27 ft. mlw), new industry such as Georgetown Steel Corporation and the Georgetown Ferreduction Corporation located in the area. Principally as a result of these recent economic industrial developments (production began in June 1969) the per capita income of the area has increased at a much more rapid rate than the remainder of the state or the average for the United States.

With each passing year the increasing conflict between channel depths and vessel size becomes more acute with the continual removal of the smaller vessels from the available world shipping fleet. The distinct possibility exists that without increased channel depths the port will not be able to continue functioning as a viable and safe harbor.

PURPOSE AND AUTHORITY

This report presents the engineering, economic, and environmental studies conducted to determine the advisability of modifying

the existing project in compliance with four Congressional resolutions, the latest of which was adopted 11 December 1969.

SCOPE OF THE STUDY

Engineering, economic/commerce, and environmental studies were made in the depth and detail needed to permit plan formulation and selection. Economic studies included investigations to determine the present and prospective commerce to be moved over the waterway. Engineering studies included investigations to determine the present and future size of vessels, channel dimensions required to accommodate vessels transiting the waterway, and estimates of the cost of constructing and maintaining contemplated improvements. Environmental studies were conducted to evaluate the effects of contemplated improvements on fish and wildlife resources and included chemical analysis of bottom sediments, and evaluation and inventory of marshlands and other habitat types.

STUDY PARTICIPANTS AND COORDINATION

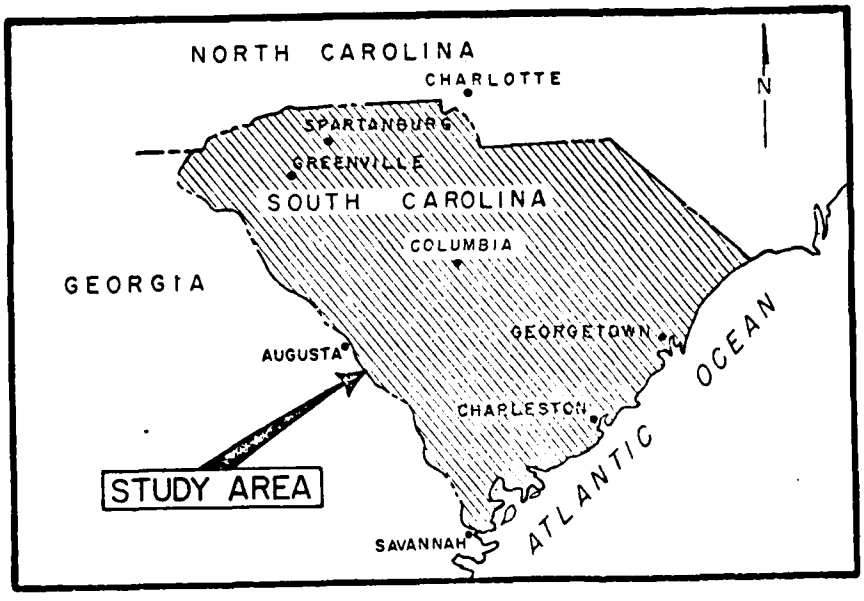
All known interested Federal, state, local agencies, and interested individuals were notified of the public meetings held at the initiation of this study and during the progress of this study. Numerous conferences were held with representatives of the South Carolina State Ports Authority and private industry. Additionally, the District Engineer coordinated the study with the U. S. Fish & Wildlife Service and the Environmental Protection Agency as well as with appropriate state and local agencies. The initial public meeting was held on 4 June 1970. A second meeting was held on 8 June 1976 to present the results of the study and solicit the views of the public concerning plan formulation and recommendations. A third meeting was held on 24 February 1977 to make public the intended favorable recommendations for project modification. A fourth meeting was held on 24 January 1978 to inform the public that circumstances had resulted in a reversal of the previously stated findings and that the recommendation would be that no modification of the existing Federal project be made at this time.

PRIOR STUDIES AND REPORTS

Numerous studies and reports have been prepared over the years on Georgetown Harbor. The first of these was authorized to be made by the River and Harbor Act of 4 July 1836. Subsequent studies lead to the successive deepening of the project, construction of jetties and alignment modifications of sheltered channels. The last report resulting in a significant modification of the authorized project was submitted on 21 February 1949 and published as Senate Document No. 21, 81st Cong. 1st Session. This document resulted in the deepening of the project to 27 feet in the inner channels and entrance channel. It also provided for the "cut off" in Sampit River which allows direct passage to the turning basin at the head of project.

Resources And Economy Of Study Area

To a large degree, the natural and human resources of an area determine the status of its economic well-being and growth potential. A general understanding of these resources and the area's developmental trends are helpful in identifying regional problems and needs. Of principal importance to the economic base of the area are agriculture, manufacturing, and port activities.



METROPOLITAN AREAS

South Carolina can be broken down into three geographic areas containing four designated metropolitan areas. The geographic and metropolitan areas are: 1. The Piedmont (Greenville and Spartanburg), 2. midland (Columbia); and 3. lower coastal plain (Charleston). Concentrated within these four metropolitan areas are 42 percent of the state's population and 47 percent of its personal income. This contrasts sharply with the national averages showing better than 70 percent of the population and personal income being located in metropolian areas. The more equal distribution of population and economic activity between metropolitan complexes, small cities, and rural areas gives the state an advantage over the nation in meeting the problems of overcrowding and pollution.

NONMETROPOLITAN AREAS

Approximately 1,494,000 people live in the 39 nonmetropolitan counties of the state, and receive $3,563 million in personal income. These 2 figures yield a per capita income of $2,385 which is 17 percent less than the per capita income in metropolitan areas and 31 percent less than the average for the entire United States.

The economy of the nonmetropolitan area counties differs from that of the metropolitan areas in several significant ways. First, and as would be expected, agriculture accounts for a much larger proportion of income in nonmetropolitan areas than in metropolitan -- 5 percent in the former and less than 1 percent in the latter. What is perhaps surprising is the relative insignficance of agricul- as a source of income in the nonmetropolitan areas of South olina as compared with the average for the nonmetrolpolitan area of the nation as a whole. That is, in South Carolina agriculture ac s for only 5 percent of total personal income in nonmetropolitan areas, but it accounts for 12 percent of total personal income in nonmetropolitan areas for the nation as a whole.

Second, manufacturing in nonmetropolitan areas of South Carolina accounts for one-third of the state's total personal income, but in the 4 metropolitan areas, it accounts for a little less than one-fourth (23.4 percent). These proportions are significantly different from those that characterize the nation's economy. In the country as a whole, manufacturing accounts for one-fourth of personal income in metropolitan areas and one-fifth of the total in nonmetropolitan areas. Thus, the nonmetropolitan areas of South Carolina are more "industrialized" than the remainder of the states or the nation as a whole.

Other income differences between metropolitan and nonmetropolitan areas in South Carolina reflect the fact that metropolitan areas tend to provide much of the trade, finance, personal services, and government required by the residents of both metropolitan and nonmetropolitan counties. As a result, these industries constitute a smaller proportion of total income in nonmetropolitan counties than in the more urbanized areas.

PROJECTED GROWTH AND PER CAPITA INCOME METROPOLITAN AREAS

Over the next 2 decades, the population of South Carolina is expected to increase by 526,000. This gain of 20 percent will be significantly less than the increase projected for the nation. South Carolina's below-average population gain, when coupled with the slightly better-than-average gain expected in personal income, is responsible for the anticipated continued improvement in the level of the state's per capita income when compared with that of the United States as a whole. In large part, the above-average gain in total income in the face of a below-average gain in population will be accomplished by utilizing a presently underemployed labor force. From a welfare standpoint, this is one of the most significant aspects of the growth and per capita income projections.

Translation of these increases in population and personal income into per capita terms yields a picture of increasing affluence in all areas. Real per capita income -- that is, excluding all price increases -- is expected almost to double in the 4 metropolitan areas combined.

POPULATION AND INCOME NONMETROPOLITAN AREAS

Population in nonmetropolitan areas is projected to increase 172,000 between 1970 and 1990, pushing total population in these areas to 1,666,000. Although the rate of population growth for the less urbanized areas is projected at a somewhat smaller rate than that for metropolitan areas, these 39 counties still will contain a major portion of the state's population(53 percent) in 1990.

Total personal income in nonmetropolitan areas will expand by a little more than $4 billion, or almost the same as in metropolitan areas. These increases will yield a per capita income in nonmetropolitan areas of $4,574. Although this represents a more rapid growth than that in the nation as a whole, per capita income in the nonmetropolitan areas of South Carolina is expected to be 25 percent below the national average in 1990. This is somewhat surprising in view of the fact that the labor force participation rate in nonmetropolitan South Carolina is projected to be a little higher than that in the nation as a whole. The implication here is that average earnings per employed person will be significantly lower in the nonmetropolitan portions of the state than in the United States.

The population and per capita income for the metropolitan areas and nonmetropolitan areas are summarized in Table 1 for 1970 and projected for 1990.

TABLE 1

POPULATION AND PER CAPITA INCOME

Economic Characteristics of South Carolina Areas In 1970

Area	Population (000)	Total Personal Income (millions of 1967 $)	Per Capita Income		Employment	
			Amount (1967 $)	Percentage of U. S.	Number (000)	Percentage of Population
United States	203,793	$706,335	$3,466	100%	79,307	39%
South Carolina	2,596	6,723	2,590	75	964	37
Metropolitan Areas	1,102	3,160	2,867	83	409	37
Charleston	304	795	2,611	75	94	31
Columbia	324	916	2,831	82	116	36
Greenville	300	924	3,080	89	127	42
Spartanburg	174	525	3,014	87	72	41
Nonmetropolitan Areas	1,494	3,563	2,385	69	555	37

Economic Characteristics of South Carolina Areas In 1990 (OBERS, SERIES E)

Area	Population (000)	Total Personal Income (millions of 1967 $)	Per Capita Income		Employment	
			Amount (1967 $)	Percentage of U. S.	Number (000)	Percentage of Population
United States	246,039	$1,517,173	$6,100	100	106,388	43
South Carolina	3,122	15,127	4,845	79	1,369	44
Metropolitan Areas	1,456	7,504	5,155	84	652	45
Charleston	338	1,705	5,039	82	141	42
Columbia	445	2,273	5,103	83	205	46
Greenville-Spartanburg	672	3,527	5,248	85	306	46
Nonmetropolitan Areas	1,666	7,623	4,574	75	717	43

DEVELOPMENT AND ECONOMY

South Carolina has established a record for long-term income growth for the state and most of its counties. With the single exception of McCormick County, total personal income grew faster, in percentage terms, in every South Carolina county than the country as a whole for the period 1929-1973.

Since 1950, South Carolina's record of rapid economic growth, though not as spectacular as the above period, has been exceptionally good. As shown in the following tabulation per capita personal income has continued to increase in terms of a percentage of the national average. Since 1959, per capita income for the state has risen from $1,330 (62% of the national average) to a record high of $4,258 in 1974, an increase of 9.6 percent over the 1973 figure. The increase in per capita personal income (Table 2) for Georgetown County closely parallels that experienced for the state as a whole.

The above-average income expansion for Georgetown County has stemmed largely from gains in manufacturing industries. As shown in Table 3, personal income by major sources, earning of factory workers make up about two-fifths of the total personal income for this county. A decline in farm income has been experienced but because this income accounts for 3 to 4 percent of the total income, the declines had little effect on the overall income flow.

Though impressive, the rapid gains in personal income experienced in the past must be evaluated in relation to relative improvement vis-a-via the other states. When ranked in terms of per capita personal income, for over four decades South Carolina has been among the bottom three. As impressive as the 1974 figure of $4,258 (9.6% above 1973) for per capita personal income sounds, the fact remains that South Carolina ranked fifth from the lowest. The future outlook concerning personal income for

TABLE 2

PER CAPITA PERSONAL INCOME

GEORGETOWN COUNTY, SOUTH CAROLINA, AND THE UNITED STATES

(CURRENT DOLLARS)

Year	Georgetown County	South Carolina	United States	PERCENTAGE OF Georgetown To S. C.	Georgetown To U. S.	South Carolina To United States
1959	998	1,330	2,161	.75	.46	.62
1962	1,212	1,537	2,351	.79	.52	.65
1969	2,130	2,767	3,705	.77	.57	.75
1970	2,451	2,963	3,943	.83	.62	.75
1971	2,754	3,170	4,157	.87	.66	.76
1972	2,953	3,500	4,497	.84	.66	.78
1973	3,243	3,885	4,921	.83	.66	.79

TABLE 3

GEORGETOWN SOUTH CAROLINA PERSONAL INCOME BY MAJOR SOURCES 1969-73 (THOUSANDS OF DOLLARS)

ITEM	1969	1970	1971	1972	1973
TOTAL LABOR AND PROPRIETORS INCOME BY PLACE OF WORK 1/					
BY TYPE					
WAGE AND SALARY DISBURSEMENTS 2/	47,131	53,718	61,753	69,298	76,547
OTHER LABOR INCOME	2,341	3,407	4,098	4,846	5,376
PROPRIETORS INCOME	8,626	8,932	9,021	11,266	13,162
FARM	1,014	1,474	1,511	1,906	3,239
NONFARM	7,612	7,458	7,510	9,360	9,923
BY INDUSTRY					
FARM	1,335	1,869	1,924	2,363	3,750
NONFARM	56,763	64,188	72,948	83,047	91,335
PRIVATE	49,510	56,011	63,846	72,818	79,930
MANUFACTURING	27,714	32,518	37,249	42,547	46,729
CONTRACT CONSTRUCTION	1,738	1,911	3,496	4,617	4,449
WHOLESALE AND RETAIL TRADE	7,847	8,523	9,391	10,038	10,675
FINANCE, INSURANCE, AND REAL ESTATE	1,157	1,232	1,568	2,075	2,804
TRANSP., COMM. + PUBLIC UTILITIES	1,558	1,560	1,876	2,209	2,397
SERVICES	9,396	10,040	10,053	10,944	12,409
OTHER INDUSTRIES	100	227	213	348	467
GOVERNMENT	7,253	8,177	9,102	10,229	11,405
FEDERAL, CIVILIAN	392	459	477	571	665
FEDERAL, MILITARY	978	1,045	1,180	1,291	1,363
STATE AND LOCAL	5,883	6,673	7,445	8,367	9,377
DERIVATION OF PERSONAL INCOME BY PLACE OF RESIDENCE					
TOTAL LABOR AND PROPRIETORS INCOME BY PLACE OF WORK	58,098	66,057	74,872	85,410	95,085
LESS: PERSONAL CONTRIBUTIONS FOR SOCIAL INSURANCE BY PLACE OF WORK	2,554	2,957	3,627	4,201	5,253
NET LABOR AND PROPRIETORS INCOME BY PLACE OF WORK	55,544	63,100	71,245	81,209	89,832
PLUS: RESIDENCE ADJUSTMENT	-716	-1,075	-1,258	-1,419	-1,272
NET LABOR AND PROPRIETORS INCOME BY PLACE OF RESIDENCE	54,828	62,025	69,987	79,790	88,560
PLUS: DIVIDENDS, INTEREST, AND RENT	7,211	8,445	9,144	9,677	10,469
PLUS: TRANSFER PAYMENTS	8,222	10,530	12,234	13,693	15,209
PERSONAL INCOME BY PLACE OF RESIDENCE	70,261	81,000	91,365	103,160	115,238
PER CAPITA INCOME	2,130	2,412	2,697	2,953	3,243
TOTAL POPULATION (THOUSANDS)	33.0	33.6	33.9	35.0	35.5

1/ EARNINGS IS THE SUM OF WAGES, OTHER LABOR INCOME AND PROPRIETORS INCOME
2/ PRIMARY SOURCE FOR PRIVATE NON-FARM WAGES: ES-202 COVERED WAGES - SOUTH CAROLINA EMPLOYMENT SECURITY COMM.

TABLE 5.00 REGIONAL ECONOMICS INFORMATION SYSTEM
BUREAU OF ECONOMIC ANALYSIS

Georgetown County is further clarified when one considers the low ranking of the State of South Carolina by national standards and that Georgetown County ranked 35th among the state's 46 counties.

ENVIRONMENTAL SETTING AND NATURAL RESOURCES OF STUDY AREA

The study area encompasses the entire State of South Carolina, as the economic benefits and other indirect effects of the port are felt statewide. The environmental effects, however, are less widely felt with the influence of harbor modifications being confined generally to Sampit River, Winyah Bay and the Atlantic Ocean, at and near the point of entrance, and to adjacent land masses.

The project area is a 40-square mile expanse of tidal water and land located near the southern tip of Georgetown County, approximately halfway between the North Carolina state line and Charleston, South Carolina. The main body of water, Winyah Bay, is a coastal estuary fed by watersheds of the Sampit, Pee Dee and Waccamaw Rivers. The bay is "S" shaped, about a mile wide at either end and approximately four miles wide in the curving center. It is dotted with islands (Marsh, Big Marsh, Pumpinseed, Rabbit, Hare and Middle Ground) of natural and artificial origin.

Peripheral land within the boundaries of the project area includes parts of South Island, Cat Island, North Island, a broad peninsula referred to as Waccamaw Neck and the mainland south of Georgetown. The only municipality located within the project area is Georgetown with a 1970 population of 10,440.

Winyah Bay is composed of the mouths of several major streams arising in South Carolina and North Carolina. The Great Pee Dee and Little Pee Dee Rivers merge north of Georgetown and with the Waccamaw form the headwaters of Winyah Bay. The Little Pee Dee and Waccamaw Rivers, with a combined drainage area of about 16,340 square miles, drain extensive swamp areas in northeastern South Carolina and southeastern North Carolina as evidenced by the "black water" nature of the streams. The Black River contributes water from another major South Carolina watershed. Sampit River, a small stream confined mainly to Georgetown County, flows into the bay south of the business direct of the city of Georgetown.

WATER QUALITY

Winyah Bay is designated as Class SC waters by the South Carolina Department of Health and Environmental Control: waters suitable for crabbing, commercial fishing and other uses except bathing or shellfishing for market purposes, or for uses requiring water of lesser quality. This classification extends from Winyah Bay entrance to the U. S. 17 bridge on the Waccamaw River arm, and in the Pee Dee River arm to near the mouth of the Black River and is the lowest water quality classification for saline waters. Saline waters of the Sampit River are also designated as Class SC. The Pee Dee upstream and the Black River (saline reaches only) are designated as Class SB: waters suitable for bathing and any other usages except shellfishing for market purposes, and for uses requiring water of lesser quality.

The saline waters of the Waccamaw upstream of the U. S. Highway 17 bridge are designated as Class SA, the highest classification of saline waters in South Carolina: waters suitable for shellfishing for market purposes and any other usages and for uses requiring water of lesser quality.

Georgetown Harbor receives treated municipal wastes from Georgetown's oxidation-pond treatment facilities and treated industrial wastes from the International Paper Corporation and the Georgetown Steel Company.

BIOLOGICAL RESOURCES

The project area is composed of six general habitat divisions. These are classified as open water, beach and dune, marsh, woodlands, agricultural land and urbanized land. The various habitat types and their biological components are closely related and interact with one another to comprise a system whose stability and productivity are dependent on each other. For this reason, no attempt is made to detail or underscore particular organisms and their values. Such an approach would detract from the importance of smaller or relatively unknown organisms and would perhaps underemphasize certain impacts due to the project.

Problems And Needs

The growth in waterborne commerce through Georgetown Harbor over the past several years reflects the rapid economic development of the South Atlantic region and the State of South Carolina. While there have been fluctuations in the volume of waterborne commerce through the port, the overall trend has been upward. The volume of commerce has increased from 1,168,000 in 1967 to 1,666,420 in 1976.

A study of the existing and prospective commerce on the waterway reveals that the existing channel is inadequate for deep draft vessels capable of handling the two main categories of commerce (ores and petroleum). As a result, there exists a need for greater channel depths to accommodate the ore carrier and tanker of the modern world fleet.

Room for future industrial expansion is severely limited along the existing waterway, however, industrial sites are available adjacent to the Sampit River above the Highway 17 bridges. Various industries have considered locating in this area.

Much of the area surrounding Winyah Bay is being managed by the State of

South Carolina for wildlife forestry research and other natural science studies. Due to the relatively undisturbed nature of the area, it is ideal for such purposes and for recreation. One of the needs of Winyah Bay area is the continued preservation of its natural resources for their usually high productivity as well as their research and recreational values.

STATUS OF EXISTING PLANS AND IMPROVEMENTS

The existing authorizations for Georgetown Harbor provide for commercial navigation consisting of a channel 27 feet deep with varying widths of 600 feet to 400 feet from the Atlantic Ocean to and including a turning basin at the U. S. Highway Bridge over the Sampit River a total of 17.9 miles. The channel is 600 feet wide across the outer bar and in the gorge and then 400 feet wide to the turning basin at the head of the project via a cutoff across the peninsular loop in Sampit with a side channel 2,400 feet long and not less than 250 feet wide leading to a turning basin at the upper end of the built-up portion of the city waterfront. The project also provides for a channel 18 feet deep and 400 feet wide along the by-passed (by the cutoff) portion of the Sampit River opposite the City of Georgetown. The harbor also has two jetties of stone on brush mattresses; the north jetty having a length of 11,139 feet and the south jetty having a length of 21,051 feet. The 400-foot wide portion of the harbor is currently being maintained at 300 feet while the authorized 18-foot channel depth along the Georgetown waterfront has been maintained to 12 feet m.l.w.

Georgetown Harbor is a link in the section of the Intracoastal Waterway between Norfolk, Virginia, and the St. John's River, Florida. This project is 12 feet deep and 90 feet wide.

Waccamaw River provides a channel 12 feet deep and 80 feet wide to Conway, 44 miles above Winyah Bay and thence a channel 4 feet deep and 50 feet wide to Red Bluff, 25 miles upstream. The lower reach of the Pee Dee River is shallow and tortuous and is not used as a commercial navigation channel. The project for Pee Dee River provides for a cleared channel 9 feet deep from the Waccamaw River, via Bull Creek to Smith Mill, mile 52. Black River flows into Pee Dee River about 5 miles above the confluence of the Pee Dee and Winyah Bay.

MODIFICATIONS DESIRED

A public meeting was held in Georgetown, South Carolina, on 4 June 1970 to determine the nature and extent of the improvements desired local interests and to afford all interested persons an opportunity to express their views regarding project improvements.

The principal improvement requested at the initial public meeting was enlargement (deepening and widening of channels) of the existing harbor. Subsequent to the meeting, channel extention up the Sampit River above the Highway 17 bridge was requested.

Modifications, therefore, were requested primarily to allow vessels deeper drafts to use the port; allow Georgetown to remain a competitive port and provide channel extensions for expanded port facilities.

NEED FOR CHANNEL MODIFICATION

The current authorized project depth of 27 feet (mlw) for Georgetown Harbor restricts the safe passage of vessels over the waterway to those having draft up to 23 feet. A four foot clearance is considered necessary between the vessel keel and channel bottom to insure maneuverability and safety. Therefore, vessels with drafts of greater than 23 feet must utilize tidal advantage and/or light loading to safely transit the waterway. Vessels of the size that can traverse the existing project are gradually being replaced by larger and more efficient vessels. The inefficiency of the smaller vessels has also been recently magnified for users, particularly the importers of the major bulk raw materials coming into Georgetown Harbor, due to the energy crisis and its accompanying sudden escalation of vessel fuel costs. Importers at Georgetown have been forced by economics to switch to the larger vessels. Commodities are off-loaded at deeper nearby port for transhipping to Georgetown generally via barges. The distance the ocean carriers must travel to the nearby port makes little difference in the cost to the importer. Transhipping, however, requires additional handling and transporting of commodities. This element of the present scheme of importation has an adverse effect on the competitiveness of receiving industries. These industries are vital to the economic stability of the City of Georgetown and the greater community.

Formulating Alternatives

Formulation of a plan of improvement to satisfy the changing deep-draft navigation demands of Georgetown Harbor requires the evaluation of several separate but interrelated aspects. Each alternative plan considered required that the evaluation of these aspects be made in sufficient detail to determine the relative merits of the plans.

FORMULATION AND EVALUATION CRITERIA

For many years the emphasis on economic growth provided the primary basis for development of water and related land resources. Development of water and related land resources was determined by technically measuring the net economic benefits relative to the costs implementation. Therefore, the least expensive plan with the greatest economic benefit was considered to be the best means of developing a resource. There has been a relatively recent awareness of the need to broaden planning objectives to consider ecological and sociological effects as well as economics.

As a result of expanding planning objectives the early 1970's witnessed the emergence of some fundamental changes in laws, policies, and regulations. The following are among the noteworthy of the changes:

1. The National Environmental Policy Act of 1969 (Public Law 91-190 referred to as NEPA). This act requires that an environmental impact statement be prepared for all major Federal actions significantly affecting the quality of the environment.

2. The River and Harbor Act of 1970 - Section 122 of the act specifies those impacts that, as a minimum, must be assessed for any proposed action;

3. The Principle and Standards for Planning Water and Related Land Resources - One of the provisions of the 1965 Water Resources Planning Act was the establishment of the Water Resources Council (WRC) with a mandate that it establish principles, standards, and procedures for Federal participation in water resources development. The Principle and Standards for Planning Water and Related Land Resources (referred to as Principle and Standards) was adopted 25 October 1973. The Principle and Standards (P & S) include four planning objectives, namely, National Economic Development (NED), Environmental Quality (EQ), Regional Development (RD), and Social Well Being (SWB). To accomplish these planning objectives P & S requires the planning process to consist of a three-stage, four task planning framework. The three study stages are: Development

of a Plan of Study (POS), Development of Intermediate Plans, and Development of Detail Plans. The four functional planning tasks are: Problem Identification, Formulation of Alternatives, Impact Assessment, and Evaluation;

4. The Federal Water Pollution Control Act (as amended in 1972) Section 404, regulates the discharge of dredged and fill material into waters of the United States;

5. The Marine Protection Research, and Sanctuaries Act of 1972, Section 103 regulates transportation for the purpose of ocean dumping; and

6. The Endangered Species Act, which was enacted in 1973, assures that Federal action will not unnecessarily alter habitat of threatened or endangered species where this habitat is critical to the survival of the species.

STUDIES

The following studies were conducted and used to evaluate the merits and disadvantages of considered modifications to the existing Federal project:

Technical
- Vessel Studies
- Subsurface Investigations
- Engineering Design
- Cost Estimates

Economic
- Commerce Studies
- Estimated Benefits

Environmental and Social

TECHNICAL CRITERIA

Technical criteria used for the formulation and evaluation of alternative solutions to the navigation problems of Georgetown Harbor are consistent with established Corps of Engineers Regulations. These regulations provided guidance for carrying out the various tasks of multi-objective planning, consistent with the Water Resource Councils, Principles and Standards and related policies described above.

ECONOMIC CRITERIA

The economic criteria which were applied in formulating a plan are those specified by the Principles and Standards. Economic benefits were developed in accordance with instructions contained in related Engineering Regulations. Additional economic criteria used in making feasibility evaluations are as follows:

1. A National Economic Development (NED) Plan is formulated to maximize the net economic benefits while addressing project objectives;

2. To recommend benefits, a NED Plan must exceed the tangible cost for the Plan;

3. All prices applied to estimated construction quantities are based on November 1977 prices;

4. A project life expectance of 50 years and an interest rate of 6-3/8 percent were used in computing project costs; and

5. Estimated construction time for alternate projects considered was less than one year; therefore, no interest was included during construction.

ENVIRONMENTAL AND OTHER CRITERIA

The following environmental criteria and intangibles were considered in plan formulation.

1. No alternative site locations or channel designs were identified which would result in a net improvement to the environment of the project

area. Siting of new offloading, storage and transportation facilities would result in considerable adverse impacts on undisturbed areas. Enlargement and/or realignment of existing channels would also result in disturbance to new areas. Accordingly, no Environmental Quality (EQ) Plan was designated;

2. In the absence of an EQ Plan that would result in net positive environmental benefits, the "no action" alternative, i.e. no change in the existing channel, would be the alternative with the least environmental impact. This would be the EQ-oriented plan;

3. Efforts were made in the development of alternative plans to minimize the environmental effects;

4. Public health, safety and social well being were considered when formulating all alternatives; and

5. Public acceptance was considered in the development of project alternatives.

EVALUATION

All considered plans were expressed in quantative economic terms (benefits and costs) to determine if the ratio of benefit to costs at least equals unity. Benefits accruing from the implementation of improvements are derived from savings in transportation costs and reductions in maintenance dredging in elements of the existing Federal navigation project. Transportation savings are the difference between expected transportation costs for commerce movements over the existing 27-foot waterway and the alternative waterway under consideration. Estimated annual equivalent benefits and annual project cost, excess annual benefits, and benefit-cost ratio for the various plans considered were derived using current prices, 50-year period of analysis, and an interest rate of 6-3/8 percent. The application of the foregoing economic criteria provided a baseline for considering the numerous other effects which are not reflected in quantifiable economic terms, but which may

have a bearing on the acceptability of the plan. At the same time that economic factors were being evaluated, data on environmental features of the project area were gathered from existing sources and new investigations for input into plan formulation (See Environmental Assessment).

POSSIBLE SOLUTIONS

For many years, channel modifications such as widening, deepening, and extending were the only considerations given to accommodating the ever-increasing size of vessels in the U. S. and world fleets utilizing American ports. There has been a relatively recent awareness of possible undesirable ecological and sociological effects resulting from the implementation of new projects and/or improvement modifications to existing projects necessitating studies to define problem areas and viable alternatives. Accordingly, the following were evaluated as possible alternatives to channel modifications:

1. Light loading in the ocean enviro ment;
2. Offshore ocean terminal;
3. Terminal located in Lower Winyah Bay;
4. Light loading at Charleston and/or Wilmington; and
5. Channel extention of Sampit River.

To satisfy the existing and future needs of the area served by the Port of Georgetown, a considered alternative to channel modification must be capable of accommodating ore carriers, freighters and possibly petroleum burdened tankers. Current usage of the Port of Georgetown is made by general cargo vessels loading and offloading at terminals in Sampit River. Only the smaller petroleum tankers still made direct calls in the Port of Georgetown. As these vessels are phased out, petroleum will have to go to Charleston where it will be off-loaded

and transhipped to Georgetown. This scheme of operation has already been tested by Hess Oil, the current petroleum importer. Iron ores destined for the port are now taken to the Port of Wilmington, North Carolina, in 38,000 ton vessels where it is offloaded for barging to Georgetown. Manufactured products moving out of the Port of Georgetown are carried as general cargo.

This current mode of operating in Georgetown Harbor is the basis for evaluating the accomplishment of other alternatives considered and is an expression of the Do Nothing Alternative required under the Principles and Standards. It is also a version of Option 4 identified above. Options 1, 2 and 5 were not found to be technically and economically feasible early in the study and were dropped for further consideration. Only Option 3 was evaluated in detail along with deepening the existing project.

For better understanding, the alternatives evaluated in the final comparison are identified as numbered plans in the following paragraphs and in the System of Accounts (SOFA). The Do Nothing Alternative is identified as Plan 5.

DEEPENING OF THE PRESENT PROJECT

Three depths, 32, 35 and 38 feet, were evaluated as possible modification of the existing project. Expected benefits fell far short of being enough to justify the cost of dredging and maintaining the larger project. Of the three depths considered, the 35-foot project was the best and this alternative is compared in the "System of Accounts" as Plan 1.

TERMINAL IN LOWER WINYAH BAY

Three site locations were selected to be investigated for a terminal in lower Winyah Bay in lieu of having a channel all the way to Georgetown.

TABLE 4

SYSTEM OF ACCOUNTS

Accounts	Plan 1 Modify Existing Project to 35 Feet	Plan 2 Western Channel 35 Feet	Plan 3 North Island 35 Feet	Plan 4 Marsh Island 35 Feet	Plan 5 Retain Existing Project 27 Feet
1. National Economic Development					
a. Beneficial Impacts (limited to Navigation benefits in immediate area)	$3,936,000 Avg. Annual Navigation Benefits 3, 5, 9	$2,757,000 Avg. Annual Navigation Benefits 3, 5, 9	$ 0 Avg. Annual Navigation Benefits 3, 5, 9	$1,204,000 Avg. Annual Navigation Benefits 3, 5, 9	
b. Redevelopment Benefit (includes maintenance dredging costs that are in excess of those applying to existing project.	$1,252,000 Avg. Annual Redevelopment Benefit.	$313,000 Avg. Annual Redevelopment Benefit.	$159,000 Avg. Annual Redevelopment Benefit.	$200,000 Avg. Annual Redevelopment Benefit.	
c. Adverse Impacts (limited to project costs in immediate area) Avg. Annual Cost	$8,700,000 Federal 1,770,000 Non-Federal $10,470,000 Total	$3,270,000 Federal 702,000 Non-Federal $3,972,000 Total	$1,170,000 Federal 0 Non-Federal $1,170,000 Total	$1,390,000 Federal 251,000 Non-Federal $1,641,000 Total	
d. Net NED Benefits	COSTS EXCEED BENEFITS	COSTS EXCEED BENEFITS	COSTS EXCEED BENEFITS	COSTS EXCEED BENEFITS	
2. Environmental Quality (limited to immediate area)					
a. Environmental quality enhanced		Plan will decrease quantity of total dredging required over 50-year project life by 7,000,000 c.y. compared to the maintenance of existing project. Comparable reduction in impacts on water quality, biological resources and fewer acres of disposal area would be disturbed. 3, 5, 9			

TABLE 4

SYSTEM OF ACCOUNTS
(continued)

Accounts	Plan 1 Modify Existing Project to 35 Feet	Plan 2 Western Channel 35 Feet	Plan 3 North Island 35 Feet	Plan 4 Marsh Island 35 Feet	Plan 5 Retain Existing Project 27 Feet
b. Environmental quality degraded	Increased need for diked inland disposal sites or ocean disposal sites over 50-year project, compared to existing project. Greater displacement of vegetation, fish and wildlife. Also more dredging (479,000,000 c.y. more than existing project over 50 years). 3, 5, 9	Areas which would likely be chosen for transportation routes to new terminal and supporting facilities would result in a loss of vegetation and fish and wildlife habitat. This loss of disturbance would take place in or adjacent to areas highly valued for these resources. 3, 5, 9	Similar to Plan 2.	Similar to Plan 2.	No change.
	Some increase in pollutants associated with anticipated secondary growth; most of secondary effects will occur in city, south of Sampit River, or in location of existing terminal. 3, 4, 10	Similar increase in pollutants due to secondary growth associated with deeper channel. Effects would be felt in a presently undeveloped area highly valued for natural resources. 3, 4, 10	Similar to Plan 2.	Similar to Plan 2.	No change.
c. Plan Evaluation					
(1) Contribution to Planning Objectives	The development of new industry in South Carolina due to the further development of the Port of Georgetown would increase the national gross product while increasing the standard of living within affected areas.	The development of new industry in South Carolina due to the further development of the Port of Georgetown would increase the national gross product while increasing the standard of living within affected areas. The new work and maintenance dredging would be less than Plan 1 thus having less adverse environmental impacts.	Same as Plan 2.	Same as Plan 2.	

TABLE 4

SYSTEM OF ACCOUNTS
(continued)

Accounts	Plan 1 Modify Existing Project to 35 Feet	Plan 2 Western Channel 35 Feet	Plan 3 North Island 35 Feet	Plan 4 Marsh Island 35 Feet	Plan 5 Retain Existing Project 27 Feet
(2) Relationship to Four National Accounts					
(a) NED	$3,936,000 Net Average Annual Benefits	$2,757,000 Net Average Annual Benefits		$1,204,000 Net Average Annual Benefits	
(b) EQ (limited to immediate area)	This plan does not contribute to the environmental quality objective. There are negative effects resulting from the increased dredging required for deepening and more disposal area needed. 3, 5, 9	Negative effects of this plan include the disturbance of bottom for new channel alignment and disturbance of previously undeveloped areas for a terminal and secondary growth. 3, 5, 9	Negative effects of this plan include the disturbance of previously undeveloped upland areas for a terminal and secondary growth. 3, 4, 10	Similar to Plan 3.	No change.
	Negative effects due to secondary growth would likely be limited to the general area of the city and Sampit River. 3, 4, 10	Positive contribution occur as a result of the reduction in amount of dredging over a 50-year period, compared to the existing project. 3, 5, 9	Positive contribution due to reduction in dredging over 50 years. 3, 5, 9	Similar to Plan 3.	No change.
	Net effect on EQ Account is negative.	Same as Plan 1.	Same as Plan 1.	Same as Plan 1.	No change.
3. Social Well Being					
a. Beneficial Impacts					
(1) Distribution of Personal Income	Increased port activity will help balance existing disparity of personnel income among counties. 2, 5, 9	Same as Plan 1.	Same as Plan 1.	Same as Plan 1.	

TABLE 4

SYSTEM OF ACCOUNTS
(continued)

Accounts	Plan 1 Modify Existing Project to 35 Feet	Plan 2 Western Channel 35 Feet	Plan 3 North Island 35 Feet	Plan 4 Marsh Island 35 Feet	Plan 5 Retain Existing Project 27 Feet
(2) Employment	Increased port activity will provide new jobs helping to meet estimated 500,000 new jobs needed in next 20 years to accommodate growing labor force of the State. 1, 6, 9	Same as Plan 1.	Same as Plan 1.	Same as Plan 1.	
(3) Community Growth	Active port will insure continued growth and job opportunities for minorities. 1, 6, 9	Future growth would occur in area now zoned for agriculture and conservation. 7 miles from Georgetown.	Same as Plan 2.	Same as Plan 2.	
(4) Displacement of People	No impact.	Construction of terminal, transportation routes & secondary growth may displace persons.	Same as Plan 1.	Same as Plan 1.	
b. Adverse Impacts					
Aesthetic	Increased use of and need for diked disposal areas will have adverse aesthetic effect. 1, 6, 9	Construction of navigation facilities, piers, docks, terminal, etc., would be aesthetically degrading to the existing undeveloped environment. 1, 6, 9	Same as Plan 2.	Same as Plan 2.	
4. Regional Development					
a. Beneficial Regional Impacts	Regional navigation benefits would be identical to those specified for NED above. 3, 5, 9	Same as Plan 1.	Same as Plan 1.	Same as Plan 1.	
	Temporary employment of persons during construction. 1, 5, 9	Same as Plan 1.	Same as Plan 1.	Same as Plan 1.	

Selecting A Plan

These three sites are referred to as the Western Channel site (Plan 2) North Island site (Plan 3), and the Marsh Island site (Plan 4). The most feasible location would be the Western Channel site due to potential rail, highway and barge connection (See Plate 1). Both of the other sites would require barging all products which would cause increased transportation costs. Channel depths of 32, 35 and 38 feet were considered for each of these sites; however, as in the case of the existing project, the optimum depth is 35 feet.

The selection of the best plan of improvement for Georgetown Harbor involved the comparison of the various alternatives which met the formulation and evaluation criteria outlined earlier. Consideration was given to environmental effects, social well-being, the regional development and the national economic development. During the selection process, all alternatives were presented for public consideration and evaluation at the Plan Formulation Public Meeting held in Georgetown on 8 July 1976.

SYSTEM OF ACCOUNTS.

The System of Accounts is a display requirement of the Water Resource Council, "Principles and Standards" and is an integral part of the planning process. The "System of Accounts" displays all significant beneficial and adverse contributions of each alternative carried through the final planning stage and provides a useful tool to assist in the selection process. The S of A also satisfies the display requirements of Section 122, Public Law 91-611, River and Harbor Act of 1970. Table 4 displays the breadth and detail of the

assessment and evaluation of all alternative plans. Table 5 summarizes Table 4 and presents the crucial planning consideration underlying each alternative. Table 5 is presented later in the section entitled, "Statement of Findings".

THE NED PLAN

The Principles and Standards require the designation of National Economic Development (NED) Plan. This plan is described as the plan which best addresses the planning objectives in a way which maximizes net economic benefits. Basically, two types of channel improvement were considered--deepening of the entire waterway from the Atlantic Ocean to the existing terminals at Georgetown and deepening of the waterway from the Atlantic Ocean to alternate terminal in lower Winyah Bay. Plan 2 (referred to as the Western Channel) came closest to having net economic benefits and although the B/C ratio is below unity, this plan is designated as the NED Plan.

THE EQ PLAN

Principles and Standards also require the designation of an Environmental Quality Plan (EQ Plan). This plan is described as the plan which will make the most significant contribution to preserving, maintaining, restoring, or enhancing cultural and natural resources. As previously discussed, there is no plan which makes a significant contribution to the environment and the Do Nothing Plan (Plan 5) is designated as the EQ-oriented plan. Plan 2 was considered the second best EQ-oriented plan.

SELECTING A PLAN

Plan selection is the designation of the most desirable alternative based on results of detailed studies. Such selections are influenced by public

opinion and preferences. When alternatives considered are found to be less desirable than the Do Nothing alternative, this alternative becomes the selected plan.

Best Plan

The preceding section summarized plan formulation and identified the plans with the best potential for resolving the problems and needs of the study area. The following pages present a description of the best plan, including its accomplishments and effects as well as its significant design, construction, operation and maintenance aspects.

PLAN DESCRIPTION

The plan closest to being economically efficient consists of deepening the existing 27-foot project to 35 feet (37 feet across the ocean bar and in the entrance channel) from the 37-foot contour in the Atlantic Ocean to channel mile 5.4, thence along the old Western Channel to a 900-foot diameter turning basin located at mile 8.5 as shown on Plate 1. This plan also provides maintenance of a channel 12 feet deep and 150 feet wide from the AIWW to existing terminals at Georgetown.

DREDGING AND DISPOSAL SCHEMES

New work and maintenance dredging would be performed with pipeline dredges and hopper dredges. Work handled by pipeline dredge would be that associated with the Western Channel and those segments of the existing project, included in the Western Channel Alterative, lying upstream of station 333+77. Hopper dredging will be performed below

this point to the ocean bars. Disposal of materials removed by pipeline dredge would be made in existing or newly-acquired areas. New areas would be on high ground above existing marsh and within economical pumping distance of shoal areas. Materials removed by hopper dredges would continue to be disposed of in the Atlantic Ocean.

DESIGN

In properly planning for a navigation modification, it is important that the modification be able to accommodate the range of vessels expected to use the waterway. There is no exact design procedure to be followed in determining the proper dimensions for maximum efficiency. Rather, each design is developed on an individual basis, taking into account those parameters which are pertinent. Normally, the important factors considered in designing a channel are (a) the depth of water under the keel of the vessel, (b) vessel loaded draft, (c) squat or sinkage, (d) maneuverability, (e) whether a passing situation exists, (f) vessel speed, and (g) characteristics of channel banks. Consideration was also given to questionnaire responses that up to a 40-foot channel is necessary to accommodate most expected vessel traffic.

CONSTRUCTION

Implementation of the Western Channel would require the removal of 7,966,000 cubic yards of granular material from mile 6.3 to mile 11.4 by pipeline dredge and 8,382,000 cubic yards of material by hopper dredge in the outer bar and entrance channel. Material removed by the hopper dredge would be placed in the existing offshore disposal area. Inner channels would be completed before the hopper dredging could be completed. Larger vessels could not use the deepened inner channel beneficially until the entrance channel and outer bars are deepened.

OPERATION AND MAINTENANCE

The operation and maintenance of the project would be relatively routine. Maintenance dredging would be required every year to remove shoal material and would average 1,120,000 cubic yards (including 120,000 cubic yards by hopper dredge). The portion of the channel which would no longer be maintained to the existing project depth would result in an estimated reduction of 1,300,000 cubic yards of maintenance dredging. The estimated quantity of shoal materials to be removed annually was determined in model studies conducted by the Waterways Experiment Station in Vicksburg. Net effects of the modification would result in a reduction of annual maintenance dredging over today's requirements by 180,000 cubic yards.

EFFECTS ON THE ENVIRONMENTAL

The major impacts associated with the location of a deeper channel and a terminal in the lower portion of Winyah Bay would be the alteration or destruction of upland and estuarine vegetation and wildlife by the construction of the facility and the location in this vicinity of a storage area, transportation routes and other necessary support features. In addition, some secondary growth could reasonably be expected to occur by private entities wanting to take advantage of the deep port. Such growth is generally associated with a lowering of water quality, displacement of wildlife and wildlife habitat, and an incompatibility with uses related to other resources such as recreation, conservation, commercial fishing and biological field research. The site of the proposed terminal is now zoned for agricultural and conservation. If zoning, water quality permits, building permits and other regulation were strictly enforced, much of the secondary growth could be prevented and the associated adverse effects avoided.

OTHER EFFECTS

Social and economic benefits will be realized in the area because of the proposed channel modifications. These include expansion of port activity and industry, additional employment, increased property values, development of satellite services, and greater diversification of the area economy. The improvements will aid the port in affecting regional goals through the growth and development of port-dependent industry throughout the state, thus, helping to effect a desirable population and industrial distribution.

Economics Of The Best Plan

METHODOLOGY

The tangible economic justification of the best plan was determined by comparing the equivalent average annual charges (i.e., interest, amortization, and maintenance costs), with an estimate of the equivalent average annual benefits which would be realized over the selected 50-year period of analysis. Appropriate values given to costs and benefits at their time of accrual were made comparable by conversion to an equivalent time basis using an appropriate interest rate. A rate of 6-3/8 percent applicable to public projects was used in this report.

COSTS

All cost estimates for the best plan include a 15 percent contingency factor and cost for engineering and design and supervision based on cost experience. The following tabulation summarizes total first cost for the Western Channel Alternative.

Table 6

SUMMARY OF FIRST COST

Item	Cost
First Costs	
Federal	
Dredging	$ 25,710,000
Navigation Aid	110,000
Subtotal	$ 25,820,000
Non-Federal	
Levees & Spillways	1,100,000
Disposal Areas	1,330,000
Berthing Areas	650,000
Subtotal	$ 3,080,000
Total First Cost	$ 28,900,000

Annual cost estimates are based on a 50-year period of analysis. Interest and amortization charges are based on an interest rate of 6-3/8 percent. The estimated cost of operation and maintenance is also included.

Table 7

SUMMARY OF ANNUAL COSTS

Interest at 6-3/8 percent	$ 1,842,400
Amortization .3039 percent	87,800
Maintenance	
Channel	1,546,000
Berthing areas & disposal areas	496,000
Total Annual Costs	$ 3,972,200

BENEFITS

Benefits that would accrue to the Western Channel Alternative would be derived from savings in transportation cost for iron ore and iron pellets, and from reduction in maintenance dredging costs. Transportation savings are the difference between cost to commerce moving on the existing 27-foot waterway and that which would be expected to move in the Western Channel. These savings would result from the use of more efficient ocean-going vessels.

Benefits derived from the importation of iron ore are computed as the difference between the cost of transhipping from the Port of Wilmington and that expected by shipping from the terminal site at the head of the Western Channel. Benefits derived from the exportation of iron pellets are based on transportation savings brought about through the use of larger vessels calling at the Western Channel which serve the European market. Some reduction had to be taken to account for costs incurred by the exporting industry in moving their product from the plant to the terminal site.

No benefits were taken for importation of petroleum commodities. With the present trend towards larger vessels, Hess Oil will probably begin again to tranship their product from Charleston via barge. Limited storage capacity at Georgetown would prevent this corporation from realizing a significant benefit from direct importation of petroleum products to Georgetown. Future plans for corporate activities at Georgetown were not devulged for use in this analysis.

Some additional transportation savings for other commodities (paper, paper products, manufactured steel, etc.) would be expected to accrue to the Western Channel Alternative. Due to the lack of sufficient information on trade routes, etc., these savings were not quantified for inclusion in the analysis.

Some savings in reduction in hazards to navigation would also take place under improved conditions. However, these savings could not be substantiated by actual damage to vessels using the existing waterway; therefore, no benefit were claimed in the analysis.

The relocation of the terminal facilities from Georgetown to lower Winyah Bay would result in the elimination of the need for maintaining the channel in the upper reaches of the waterway. This would result in a dredging savings of 1,300,000 cubic yards a year. This yardage reflects only the pay yardage which is annually removed from project elements which will no longer be maintained.

Evaluated benefits, based on November 1977 prices, are shown in the table on the following page.

Table 8

ANNUAL EQUIVALENT BENEFITS
($1,000 rounded)

Type of Benefit	
Savings in Transportation Costs	
(1) Iron Ore	1,204
(2) Pellets	6
Reduction in Maintenance Dredging	1,547
Total	2,757

JUSTIFICATION

The following tabulations indicate how the average annual benefits compare with the average annual costs for the best plan. Only direct tangible values are represented. Not shown are the increased employment, wages, salaries, profits which would be generated by new industries.

Table 9

SUMMARY OF ECONOMIC ANALYSIS
WESTERN CHANNEL
($1,000 rounded)

Item	
Average Annual Benefits	2,757
Annual Costs	3,972
Economic Ratio-Benefits/Cost	0.69

REDEVELOPMENT BENEFITS

Redevelopment benefits consist of the labor income accruing to those living within the project area who would be unemployed but for the construction of the project. There are at least 3 Title IV counties within commuting distance of Georgetown; these are Georgetown, Williamsburg, and Marion Counties. According to the 1976 "Manpower in Industry", published by the Employment Security Commission of South Carolina, unemployment in these three counties totalled 4,890 or 11 percent of their total civilian labor force of 44,380.

Redevelopment benefits are based on estimated costs of contract dredging. Contract cost for the Western Channel Alternative is estimated at $25,345,000. There would be no increase in annual maintenance over that currently being performed; therefore, no maintenance costs have been included as being attributable to redevelopment. The labor component of dredging contract work is described in Bulleton 1390, BLS, Department of Labor, entitled "Labor and Material Requirements for Civil Works Construction by the Corps of Engineers." Costs in this study essentially apply to the year 1960. For 1977, the Engineering News Record Construction Cost Index was 3.054 times greater than the same index figure for 1960. The Bulletin shows that in 1960 there were 133.9 man hours per $1000 of dredging construction contracts; in 1977 this would be 133.9/3.054 = 43.8 man hours per $1000, assuming labor cost increases to have been proportional to construction cost increases. Using the BLS breakdowns by skill levels indicated by the various occupations and current hourly wage figures, the following estimate is made of wages accruing to local hires for this work.

Table 10

WAGES ACCRUING TO LOCAL HIRES

	Manhours/$1000		Locally Supplied			
	1960	1977	% Locally supplied	Man-hours per $1000	Hourly Rate	Wages per $1000
Skilled	57.6	25.2	20	5.04	$10.00	$ 50.40
Semi-Sk	22.8	10.0	40	4 0	7.30	29.20
Unskilled	53.5	23.4	80	18.72	5.60	104.82
Totals	133.9	43.8		27.76		$184.43

Using the above relationships, it is apparent that the Western Channel Alternative would result in $4,674,000 benefit to local labor. Amortizing this over a fifty-year period yields an average benefit of $321,000. These benefits are a quantification of Regional Economic Development benefits and are displayed in the System of Accounts. They are not used, however, in evaluating the National Economic Development efficiency of the Western Channel and other alternatives.

Discussion

The economic development of South Carolina has grown at a steady rate during the last decade. Much of the economic growth and future development is directly dependent on the ports in the state. Despite the economic improvement of the past decade, the state remains near the bottom, 46th, in per capita income. Analysis of per capita income further reveals a disproportionate distribution among the state's 46 counties. Population is generally distributed in much the same way as is aggregate income, inasmuch as income earners and their families gravitate toward areas of economic opportunity. Therefore, if the port is to fulfill its destined role affecting regional goals through the growth and development of port-dependent industry throughout the state (thus helping to effect a desirable population and economic distribution) the port must become a viable and safe harbor adequately serving the future needs imposed by shippers and vessels. Various solutions to the problems and needs of continued harbor development were analyzed. Based on the economic and engineering studies conducted, no plan was found to be economically justified. The plan which presented the best return of investment consists of a 35-foot deep channel from the Atlantic Ocean to a turning basin and offloading facility located in the Western Channel in lower Winyah Bay. Estimated investment and annual charges are $28,900,000 and $3,972,000, respectively. Average annual benefit is $2,757,000 with a benefit-cost ratio of 0.69 to 1.

The major impacts associated with the location of a deeper channel and a terminal in the lower portion of Winyah Bay would be the alteration or destruction of upland and estuarine vegetation and wildlife by the construction of the facility and the location in this vicinity of a storage area, transportation routes and other necessary support features. In addition, some secondary growth could reasonably be expected to occur by private entities wanting to take advantage of the deep port. Such

growth is generally associated with a lowering of water quality, displacement of wildlife and wildlife habitat, and an incompatibility with uses related to other resources such as recreation, conservation, commercial fishing and biological field research. The site of the proposed terminal is now zoned for agriculture and conservation. If zoning, water quality permits, building permits and other regulation were strictly enforced, much of the secondary growth could be prevented and associated adverse effects avoided.

Social and economic benefits of implementation of the best plan would include increased employment and property values, continued diversification of the state's economy, transportation savings, and expansion of port activity and related industry. A profile of the social, environmental and ecological implications of implementation of the plan and other alternatives considered during project formulation are shown in Table 4 in compliance with the directive of Congress contained in Section 122 of the Rirer and Harbor and Flood Control Act of 1970 (P. L. 91-611).

At the project formulation meetings held in Georgetown on July 10, 1976 and 24 February 1977, the following summarized study findings to that date were announced:

1. Deepening of the existing Georgetown Harbor Navigation Project all the way to the Highway 17 bridge of Georgetown is economically and environmentally unjustifiable and, therefore, cannot be recommended.

2. Extending the existing project upstream on the Sampit River above the Highway 17 Bridge is unjustifiable and, therefore, cannot be recommended.

3. The only feasible solution which would help Georgetown Harbor to compete with other ports by accommodating the deeper draft vessels now in use would be to provide a 35-foot deep channel from the Atlantic

Ocean to an offloading terminal in Lower Winyah Bay. In order for this alternative to be recommended, local support and assurances of the sponsor to provide the items of local cooperation will be required. Lacking such assurances, a favorable recommendation cannot be made.

The Western Channel alignment was generally acceptable to the local people. South Carolina State Ports Authority, the local sponsor of the project, continued to express a preference for deepening the entire 27-foot project, however, they did provide a letter which expressed their intent to provide the items of local cooperation for the Western Channel Alternative.

Subsequent to the two public hearings mentioned above, a draft report on Georgetown Harbor was submitted to the South Atlantic Division Office for review. As a result of this review, it was judged that some of the basic assumptions presented in the draft report were no longer applicable and that an update of costs and benefits would be necessary. The reanalysis and reformulation of the benefits and first cost resulted in the benefits-cost ratio for the Western Channel dropping below unity. The major factors which nullified the economic feasibility of the 35-foot Western Channel Alternative are listed below:

1. The benefits claimed for savings in reduced maintenance cost was based on maintenance dredging prior to 1974 plus an assumed yardage for the side channel at Georgetown since the side channel had not been dredged for a sufficient period to determine a dredging rate. Benefits were also calculated on twice a year dredging. Maintenance in the last few years has not been as great as was previously projected. In addition to this, Georgetown Ferreduction has begun using vessels in the 38,000 DWT range to import iron ore to Wilmington for transshipment by barge to Georgetown. These vessels cannot use Georgetown Harbor even light loaded, therefore, the need and economic justification for twice a year dredging has been

eliminated. This further reduces the savings in maintenance dredging previously claimed making the base condition for figuring savings in reduced maintenance cost once a year dredging.

2. Initial assumption was that the costs for new facilities required at the terminal in lower Winyah Bay would be self-liquidating and would not be a part of the project costs. After an examination of Federal policy, it was determined that these costs should be reflected as handling or transfer costs and that the benefits should be reduced accordingly.

3. Benefits for petroleum imports were not allowed since it was impossible to verify that industry's intentions concerning their Georgetown Harbor operations.

4. Benefits for reducing hazards to navigation were not taken due to the lack of documentation of actual damage experiences on the existing project.

Statement Of Findings

This report was reviewed and evaluated, in light of the overall public interest, as well as the stated views of other interested agencies and the concerned public, to determining the need and advisability, including the various practical alternatives, of modifying the existing navigation projects for Georgetown Harbor.

The possible consequences of these alternatives have been studies for environmental, social well-being, and economic effects, including regional and national economic development and engineering feasibility.

In evaluating the Western Channel and other considered alternatives, the following points were considered pertinent:

a. Environmental considerations. Approximately 554 acres of diked disposal area will be needed for disposal of the estimated 8,284.000 C.Y. of material to be removed during construction of the best plan. Additionally, about 31 acres will be needed annually for disposal of the increase in shoal material resulting from deepening during normal maintenance operations. The major environmental effect would be the alteration or destruction of highly valued estuarine and upland resources by the location of a terminal, support features and secondary growth in this area.

b. Social well-being considerations. The Western Channel will have favorable implications for the socio-economic well-being of state residents. In addition, the creation of new jobs to insure adequate employment for the projected future labor force in part depends on the continued growth of the port and related industries. The continued growth of the port will assist in maintaining the existing favorable distribution of population and economic activity between metropolitan complexes, small cities, and rural areas.

c. Engineering considerations. Of the possible solutions considered, modification (deepening and widening) of the Georgetown Harbor

channels is considered to be the most responsive means of the port to meet future demands of vessels and shippers, however, channel deepening of the total existing project was not considered economically feasible because of the high cost of initial dredging involving pinnacle limestone rock at depths greater than 29 feet and the high maintenance cost. The best alternative considered was a 35-foot deep channel to a turning basin located in lower Winyah Bay. The various commodities handled in the port could be offloaded at this location and shipped to outbound destinations and/or transported to present terminal facilities in the Sampit River.

d. Economic considerations. Channel depths varying from 32 to 38 feet were considered for Georgetown Harbor along with various alternatives such as an offshore terminal, lightering and a terminal in lower Winyah Bay. A channel to a terminal located in lower Winyah Bay was considered the best alternative plan, however, it too was found to be economically unfeasible.

Based on engineering costs studies, the estimated first cost and annual charges for the channel to the Western Channel Alternative terminal site are summarized as follows:

Summary of Economic Analysis

Plan of Improvement

Average Annual Benefits	$2,757,000
Annual Costs	$3,972,000
Economics Ratio-Benefits/Cost	0.69

The action as proposed, as developed in the Conclusions and Recommendations, is based on thorough analysis and evaluation of various practicable alternative courses of action for achieving the stated objections. The

TABLE 5

SUMMARY-SYSTEM OF ACCOUNTS

Accounts	Plan 1 Modify Existing Project to 35 Feet	Plan 2 Western Channel 35 Feet	Plan 3 North Island 35 Feet	Plan 4 Marsh Island 35 Feet	Plan 5 Retain Existing Project 27 Feet
1. Significant Impact					
a. Economic					
(1) Local Government	The presently estimated non-Federal share of the total first cost of this plan of improvement is $7,110,000 and equivalent to about 10 of the total. The estimated non-Federal annual charge is $1,770,000. First costs and annual charges are in addition to costs for maintaining waterway with no action. $3,936,000 net average annual benefits.	The presently estimated non-Federal share of the total first cost of this plan of improvement is $3,080,000 and equivalent to about 17 of the total. The estimated non-Federal annual charge is $702,000. First costs and annual charges are in addition to costs for maintaining waterway with no action. $2,757,000 net average annual benefits.		The presently estimates non-Federal share of the total first cost of this plan of improvement is $880,000 and equivalent to about 5% of the total. The estimated non-Federal annual charge is $251,000. First costs and annual charges are in addition to costs for maintaining waterway with no action. $1,170,000 net average annual benefits.	
(2) Regional Growth	Probable increase in growth due to increased tonnage entering area and lower transportation cost.	Same as Plan 1.	Same as Plan 1.	Same as Plan 1.	
(3) Employment and Labor Force	During next 20 years an estimated 500,000 new jobs must be created. This plan would enable the Port of Georgetown to continue to create new jobs throughout the study area.	Same as Plan 1.	Same as Plan 1.	Same as Plan 1.	
(4) Business and Industrial Growth	An increase in business and industrial growth throughout the study area can be expected.	Same as Plan 1.	Same as Plan 1.	Same as Plan 1.	

TABLE 5

SUMMARY-SYSTEM OF ACCOUNTS
(continued)

Accounts	Plan 1 Modify Existing Project to 35 Feet	Plan 2 Western Channel 35 Feet	Plan 3 North Island 35 Feet	Plan 4 Marsh Island 35 Feet	Plan 5 Retain Existing Project 27 Feet
(5) Distribution of Personal Income	Increased port activity will help balance the disparity among the counties.	Same as Plan 1.	Same as Plan 1.	Same as Plan 1.	
b. Social					
(1) Displacement of People	No impact foreseen in the near future.	Persons in area of terminal, secondary growth and transportation routes would be displaced.	Same as Plan 2.	Same as Plan 2.	
(2) Community Growth	Will encourage continued growth of the community.	Will encourage growth in the area of the community, some growth in areas not anticipated by City or County planning.	Same as Plan 2.	Same as Plan 2.	
(3) Aesthetic Values	Increased dredging quantities will require more diked disposal areas.	Less dredging over 50-year period. Terminal and secondary growth in presently undeveloped area. Would disturb highly valued resources.	Less dredging over 50-year period. Terminal and secondary growth in presently undeveloped area. Would disturb highly valued resources.	Less dredging over 50-year period. Terminal and secondary growth in presently undeveloped area. Would disturb highly valued resources.	
c. Environmental Effects (limited to immediate area)					
(1) Natural Resources	Additional land disposal areas needed. Various marine and wildlife communities would be effected. Adverse effects of turbidity will be periodic. 552,000,000 c.y. of material will be removed over 50 years. 3, 5, 9	Major effect is the expected displacement of natural resources by the construction terminal & growth. 80,000,000 c.y. will be removed over 50 years. 3, 5, 9	Similar to Plan 2, except 30,000,000 c.y. will be removed over 50 years. 3, 5, 9	Similar to Plan 2, except 35,000,000 c.y. will be removed over 50 years. 3, 5, 9	No change in present demand of 74,000,000 c.y.

TABLE

SUMMARY-SYSTEM OF ACCOUNTS
(continued)

Accounts	Plan 1 Modify Existing Project to 35 Feet	Plan 2 Western Channel 35 Feet	Plan 3 North Island 35 Feet	Plan 4 Marsh Island 35 Feet	Plan 5 Retain Existing Project 27 Feet
(1) Natural Resources (continued)		Natural resources in a highly prized area disturbed by terminal and secondary growth. 3, 5, 9	Similar to Plan 2.	Similar to Plan 2.	No change.
(2) Pollution Aspects					
(a) Air	No significant impact directly from shipping and increased tonnage, but indirectly an increase could occur due to an increase in industry attracted to the area. 3, 4, 10	Similar to Plan 1, except any increase due to secondary growth would occur in presently undeveloped area. 3, 4, 10	Similar to Plan 2.	Similar to Plan 2.	No change.
(b) Water	Increased turbidity during dredging operations but of short duration. 3, 5, 9	Similar to Plan 1, except any increase due to secondary growth would occur in presently undeveloped area. 3, 5, 10	Similar to Plan 2.	Similar to Plan 2.	No change.
	Some increase likely, if increased development occurs, in surface runoff, point discharges and spills. 3, 4, 10				
2. Plan Evaluation					
a. Contribution to Planning Objectives	The development of new industry in South Carolina due to the further development of the Port of Georgetown would increase the national gross product while increasing the standard of living within affected areas.	The development of new industry in South Carolina due to the further development of the Port of Georgetown would increase the national gross product while increasing the standard of living within affected areas. The new	Same as Plan 2	Same as Plan 2.	

TABLE 5

SUMMARY-SYSTEM OF ACCOUNTS
(continued)

Accounts	Plan 1 Modify Existing Project to 35 Feet	Plan 2 Western Channel 35 Feet	Plan 3 North Island 35 Feet	Plan 4 Marsh Island 35 Feet	Plan 5 Retain Existing Project 27 Feet
a. Contribution to Planning Objectives (continued)		work and maintenance dredging would be less than Plan 1. Plan 2 has greater impact than the existing project but the smallest impact of the deepening plans.			
b. Relationship to Four National Accounts					
(1) NED	$3,936,000 net annual average benefits	$2,757,000 net annual average benefits		$1,204,000 net annual average benefits	
(b) EQ	This project does not contribute to the environmental quality objective. Adverse effects resulting from the increased amount of dredged material which will be removed as a result of deepening. There will also be an increase in material to be removed during maintenance dredging after the project is completed.	Net impact on EQ account is negative. Major adverse impact on highly prized natural resources in lower Winyah Bay.	Similar to Plan 2.	Similar to Plan 2.	
(c) SWB	Will aid in fulfilling statewide need for new job opportunities. Will help balance the disparity of personal income among counties.	Same as Plan 1.	Same as Plan 1.	Same as Plan 1.	

TABLE 5

SUMMARY-SYSTEM OF ACCOUNTS
(continued)

Accounts	Plan 1 Modify Existing Project to 35 Feet	Plan 2 Western Channel 35 Feet	Plan 3 North Island 35 Feet	Plan 4 Marsh Island 35 Feet	Plan 5 Retain Existing Project 27 Feet
(d) RD	Benefits are proportional to and roughly equal to net average NED benefits.	Same as Plan 1.	Same as Plan 1.	Same as Plan 1.	
c. Plan Response to Associated Evaluation Criteria					
(1) Acceptability	This plan is acceptable to locals. Somewhat below Plans 2 and 3.	This plan not acceptable to the Georgetown County Industrial Commission interested in developing Sampit River.	This plan not acceptable to the Georgetown County Industrial Commission interested in developing Sampit River.	This plan not acceptable to the Georgetown County Industrial Commission interested in developing Sampit River.	
(2) Completeness	All steps necessary to achieve stated outputs of Plan 1 are included as part of the plan.	All steps necessary to achieve stated outputs of Plan 4 are included as part of the plan.	All steps necessary to achieve stated outputs of Plan 5 are included as part of the plan.	All steps necessary to achieve stated outputs of Plan 7 are included as part of the plan.	
(3) Efficiency and Effectiveness	Lowest of all plans in efficiency and effectiveness.	Ranks 1 of channel modification plans.	Ranks 2 of 4 structural plans.	Ranks 4 of 4 structural plans.	
(4) Certainty	80%	80%	80%	80%	
(5) Geographical Scope	Limited to study area.	Limited to study area.	Limited to study area.	Limited to study area.	
(6) NED B/C Ratio	.38	.69	.0	.71	
(7) Reversibility	All structural plans could be reversed in time necessary for environment to revert to original condition.	All structural plans could be reversed in time necessary for environment to revert to original condition.	All structural plans could be reversed in time necessary for environment to revert to original condition.	All structural plans could be reversed in time necessary for environment to revert to original condition.	
(8) Stability	Very stable.	Very stable.	Very stable.	Very stable.	

TABLE 5

SUMMARY-SYSTEM OF ACCOUNTS
(continued)

Accounts	Plan 1 Modify Existing Project to 35 Feet	Plan 2 Western Channel 35 Feet	Plan 3 North Island 35 Feet	Plan 4 Marsh Island 35 Feet	Plan 5 Retain Existing Project 27 Feet
3. Implementation Responsibility					
a. Federal	Initial construction and yearly maintenance of Federal project.	Initial construction and yearly maintenance of Federal project.	Initial construction and yearly maintenance of Federal project.	Initial construction and yearly maintenance of Federal project.	
b. Non-Federal	Provide right-of-way disposal area including dikes and spillways for initial construction and annual maintenance of terminal facilities and berthing areas.	Provide right-of-way disposal area including dikes and spillways for initial construction and annual maintenance of terminal facilities and berthing areas.	Provide right-of-way disposal area including dikes and spillways for initial construction and annual maintenance of terminal facilities and berthing areas.	Provide right-of-way disposal area including dikes and spillways for initial construction and annual maintenance of terminal facilities and berthing areas.	

recommended action is consonant with national policy, status, and administrative directives, and on balance, the total public interest should best be served by the implementation of the recommendations.

Recommendations

The District Engineer recommends that the Federal navigation project for Georgetown Harbor not be modified at this time.

William W. Brown

WILLIAM W. BROWN
Colonel, Corps of Engineers
District Engineer

REVIEW OF REPORTS
GEORGETOWN HARBOR
SOUTH CAROLINA

INFORMATION CALLED FOR BY
SENATE RESOLUTION 148, 85TH CONGRESS
ADOPTED JANUARY 28, 1958

1. Authority. The following information is furnished in response to Senate Resolution 148, 85th Congress, adopted January 28, 1958.

2. Requests by local interests. At a public meeting held in Georgetown, South Carolina, on 4 June 1970, and by subsequent conferences and correspondence, local interests requested waterway improvements generally to provide for deepening the existing 27-foot navigation channel to 40 feet. Subsequently, requests were made to include channel extension, above Highway 17 bridge, in the Sampit River.

3. Improvements considered. Two plans of improvement with varying project depths were considered. The two plans were:

(1) Modification of the existing Georgetown Harbor Project to provide increased channel widths and depths; and,

(2) provision of an offloading facility and turning basin in lower Winyah Bay.

Improved project depths of 32, 35, and 38 feet m.l.w. were considered for the existing waterway and for three locations in lower Winyah Bay investigated for the offloading facility and turning basin. These investigations revealed that the best plan would be an offloading facility and turning basin in the Western Channel in lower Winyah Bay.

4. A comparison of the estimated costs and benefits for the Western Channel, based on 50-year and 100-year periods of analyses and an interest rate of 6.375 percent, is shown in the following table:

ESTIMATED ANNUAL CHARGES AND BENEFITS
FOR THE RECOMMENDED PLAN OF IMPROVEMENT

Federal investment	$25,820,000
Non-Federal investment	$ 3,080,000
Total investment	$28,900,000

	Period of analysis (years)	
	50	100
Annual charges (rounded)		
Federal	$3,270,000	$3,195,000
Non-Federal	$ 702,000	$ 693,000
Total annual charges	$3,972,000	$3,888,000
Average annual equivalent benefits	$2,757,000	$2,781,000
Benefits to costs ratio	0.69	0.72

William W. Brown

WILLIAM W. BROWN
Colonel, Corps of Engineers
District Engineer

ENVIRONMENTAL ASSESSMENT

GEORGETOWN HARBOR DEEPENING STUDY
GEORGETOWN COUNTY,
SOUTH CAROLINA

Prepared by
U. S. ARMY ENGINEER DISTRICT, CHARLESTON, SOUTH CAROLINA

JANUARY 1978

SUMMARY

GEORGETOWN HARBOR DEEPENING STUDY

ENVIRONMENTAL ASSESSMENT

Responsible Office: U. S. Army Engineer District
P. O. Box 919
Charleston, South Carolina 29402
Telephone: 803-577-4171, Ext. 259

1. Name of Action: ( ) Administrative (X) Legislative

2. Description of Action (See plate 1):

Plan A - No change; maintain existing channel 27 feet deep from the Atlantic Ocean to Georgetown.

Plan B - Deepen existing channel to 35 feet along entire length to Georgetown.

Plan C - Deepen to 35 feet a portion of the existing lower channel; construct a new 35-foot channel to a new turning basin and terminal on what is now Estherville Plantation, and abandon the remaining portion of the existing 27-foot project.

3. Environmental Impacts Common to All Plans: The three plans have some environmental impacts in common which vary in degree according to the amounts of dredging with each plan. These impacts are periodic increases in turbidity and sedimentation during dredging; smothering of plant and animal communities in disposal areas; temporary frightening of birds and mammals in the area; temporary reduction of phytoplankton and zooplankton; periodic reduction of benthic organism populations in the path of the cutterhead and in the offshore disposal area; increase in the local mosquito population; possible adverse effect on fish larvae due to increased turbidity; and possible reduction in dissolved oxygen levels as a result of the dredge disturbing organic materials undergoing anaerobic decomposition.

a. Plan A involves no new construction. Annual maintenance dredging of 2,034,000 C.Y. per year over the 50 year project life amounts to 101,700,000 C.Y. This requires the equivalent of 58 acres of upland disposal area per year, or a 50-year total of 2,900 acres.

b. Plan B involves 22,505,000 C.Y. of dredging for new channel work, or the equivalent of 880 acres of disposal area. This plan has the highest maintenance requirement (6,363,000 C.Y. per year) and, when added to the new work, would total 340,655,000 C.Y. of dredging for the

50-year life of the project. This is the equivalent of 10,330 acres of disposal area over the life of the project.

c. Plan C involves 16,348,100 C.Y. of dredging for new channel work, or 500 acres of disposal area. Annual maintenance of 1,290,000 C.Y. is the lowest of the three plans. Dredging over the 50-year project life would total 80,848,000 C.Y. or 2,050 acres of upland disposal area.

4. Environmental Impact Particular to Each Plan: In addition to the impacts which are common to all three plans, Plan B would likely require blasting to remove some rock in the upper portion of the channel. Plan B would also invite future industrial development in the City of Georgetown area and resultant increases in commercial and residential areas. The major adverse impact of Plan C would be the relocation by the State Ports Authority and private companies of terminal facilities from Georgetown to an undeveloped, rural area. Construction of roads, powerlines and possibly a railroad would be expected. Secondary development for storage and supporting commercial or industrial companies would contribute to adverse effects on vegetation, water quality, fish and wildlife habitat, and cultural resources in an area which is highly valued for these features. This shift of shipping and related activities to an area seven miles from Georgetown would require a change in present zoning policy and an adjustment by the local commercial concerns.

5. Alternatives. In addition to the three plans described above, sites for a channel and terminal were investigated for Marsh Island and North Island. Channels of 32, 35 and 38 feet were investigated for each alternative. Pipelines, lighterage systems and offshore terminals were also considered early in the planning stages, but were rejected early because they could not provide safe shipping improvements that could serve the major users and thus did not meet the study objectives.

GEORGETOWN COUNTY,
South Carolina

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APPENDICES

1.0 Project Description.

1.01 Authorization. The existing 27-foot channel from the Atlantic Ocean to Georgetown was authorized by the following River and Harbor Acts: 5 August 1886-H. Ex. Doc. 258, 48th Cong., 2d sess.; H. Ex. Doc. 117, 50th Cong., 2d sess:, H. Doc. 298, 58th Cong., 2d Sess.; H. Doc. 211, 76th Cong., 1st Sess.; 30 June 1948 - S. Doc. 21; 81st Cong., 1st Sess. Authority for studies to modify the existing project comes from resolutions which were adopted by the Committee on Public Works of the House of Representatives and which were adopted on 31 July 1957, 10 July 1968, 8 September 1969 and 11 December 1969. Project authorization requires that the project sponsor, the South Carolina State Ports Authority, select and provide all areas needed for the disposal of dredged material.

1.02 History. The existing project was completed in 1952 and has been maintained annually to date. The current practice of dredging to a depth of 29 feet (27 feet, plus two feet overdepth) has not provided year-round project depth. Controlling depths of 18 feet have been experienced between the annual maintenance efforts. Accordingly, approval has been obtained under existing authority for performing maintenance dredging to a depth of 29 feet at six-month intervals for the reach between Station 720+00 to 790+00 and to a depth of 31 feet at six-month intervals for the reach between Station 890+00 to the Georgetown turning basin, including the side channel. Implementation of this proposal for additional dredging is conditional on the provision of 400 acres of suitable disposal area by the project sponsor. This condition has not been satisfied at this time.

1.03 Present and anticipated limits of existing project. Even if maintenance were performed twice annually, a 27-foot channel would not accommodate the increasingly larger oceangoing vessels. The larger vessels now have to light-load at Charleston or Wilmington before proceeding to Georgetown. Other shipments are transferred to barges at the two deeper ports and moved to Georgetown on the Atlantic Intracoastal Waterway. Should the present trend to larger vessels continue, it is possible that the major users of Georgetown Harbor would go to other methods of shipping to realize at least a portion of the benefits from larger vessels. These methods might include barging, rail service or trucking from deeper ports, or a major user might construct his own deep water terminal and channel. If, for any reason, a large portion of the present users no longer used the existing 27-foot channel, the channel might be deauthorized. This assumes that the remaining benefits of the channel would no longer justify the costs of maintenance.

1.04 The present study, then, is an attempt to determine whether a feasible method exists to (1) realize the full potential of economic

benefits from deeper vessels, (2) to provide the Georgetown area with a project that will remain viable with the anticipated changes in size of ocean vessels, and (3) to avoid unacceptable impacts on the environment of the Winyah Bay area. The number of feasible alternatives is limited by the extremely high shoaling rates in the upper harbor, rock in the upper harbor, and the lack of accessibility to all users of many sites in the middle or lower region of the harbor. The many plans studied fall into three general categories: (1) Retain the existing project as long as it is justified and then rely on barges, rail or other transportation to supply the present users. (2) Provide a deeper channel all the way to Georgetown, and (3) locate a terminal with a deeper channel in the lower part of Winyah Bay. Of the sites in the lower harbor, all but a channel to Estherville (Plan C) were rejected due to the major problems discussed in Section 6.0. None of the plans for a deeper channel all the way to the City of Georgetown can presently be justified; however, the best plan of this type is fully discussed as Plan B because of the popular support for a project of this nature. Plan A discusses maintaining the existing project.

1.05 Plan A - No change. The existing channel would be maintained at its present 27-foot depth. Widths vary from 400 to 600 feet along the project length as shown in Plate 1 from the Atlantic Ocean to a turning basin in the Sampit River. A side channel 2,400 feet long and not less than 200 feet wide leads to a turning basin at the upper end of the built-up portion of the city waterfront. The bypassed portion of the Sampit River opposite the City of Georgetown is maintained at 18 feet deep and 400 feet wide. The channel is widened at the bends and secured and maintained by two jetties of stone on brush mattresses leading respectively from North and South Islands. The north jetty is 11,139 feet long and the south jetty is 21,051 feet long. This plan is the same as that described in the March 1976 Final EIS on Maintenance Dredging of Georgetown Harbor.

1.06 Plan B - Deepen existing channel to 35 feet. Bottom width, length, alignment and jetty structure would be the same as described above, but new excavation would be necessary to deepen the channel from 27 to 35 feet, resulting in a greater top width. Thereafter, the channel would be maintained at a depth of 35 feet. Because of the high shoaling rates in the upper harbor, dredging twice annually would have to be to a depth of 48 feet in order to maintain a channel depth of 35 feet. (See Section 2.02.)

1.07 Plan C - Terminal in lower Winyah Bay. The lower portion of the existing channel would be deepened to 35 feet from the Atlantic Ocean to the northern tip of South Island. From this point, a new 35-

foot channel would be dredged along Cat Island to a point just past the intersection of the new channel with the Atlantic Intracoastal Waterway. Here a turning basin with a turning diameter of 1000 feet would be constructed adjacent to a proposed new terminal site on an old dredged material disposal area on Esterville Plantation. The new channel would be 300 feet wide; the bottom width and alignment of the lower portion would be the same as with the existing channel. The remainder of the existing 27-foot channel (the Eastern Channel and upper channel to Georgetown) would be deauthorized upon completion of the new channel. Thereafter, the deauthorized portion of the existing channel between the Atlantic Intracoastal Waterway and the terminal areas in Georgetown would be maintained at 12 feet.

108.0 Dredging. Table 1 indicates the amounts of dredging necessary to construct and maintain the three alternative channels.

Table 1

	New Construction	Annual Maintenance	50-Year Maintenance	Total (C.Y.)
Plan A				
Maintain Existing 27-Foot Channel	0	2,034,000	101,700,000	101,700,000
Plan B				
Deepen Existing Channel to 35 Feet	22,505,000	6,363,000	318,150,000	349,655,000
Plan C				
Provide 35-Foot Channel to New Terminal in Lower Harbor	16,348,000	1,290,000	64,500,000	80,848,000

108.1 Several methods of dredging can be used for any of the three alternatives. A combination of these dredging methods would be employed over the 50-year life of the project. The number of C.Y. removed by

each method would depend on the availability of newer equipment, the development of criteria by EPA for disposal, the ability of the local sponsor to provide acceptable disposal areas, the consensus of interagency coordination meetings, as well as other economic, engineering and environmental considerations.

108.2 Hydraulic dredge and pipeline. This method is now being used to remove material from the inner portions of the harbor. Until such time as the special dredge described in Section 1.08.4 is available or new disposal methods as discussed in Section 1.09.2 are developed, hydraulic dredging will continue to be used with a pipeline leading to disposal areas (see plate 1). Except for a marsh-building experiment, the material dredged by this method is now being deposited in three diked disposal areas: Waccamaw Point (220 acres), Waccamaw Neck (320 acres) and Sampit River (260 acres). Under present use, these areas will reach capacity about 1985. If one of the deepening alternatives were implemented, additional upland disposal areas would be required for initial construction and maintenance. Likely locations and their areas are shown in Plate 1A. New disposal areas would be selected by the interagency coordination described in Section 1.09.5. If a deepening alternative is selected, material suitable for ocean disposal could be pumped from the lower harbor area and placed along the ocean beaches. Much of this material is sand which is well suited for beach nourishment.

1.08.3 Hopper dredge. The entrance portion of the harbor is now maintained by use of a hopper dredge. The predominantly sandy material is deposited in an EPA-approved offshore disposal site, and would be similarly disposed of under the deepening alternatives. If a deepening alternative is chosen, some increased use of hopper dredging might be made to remove sand and shell for new construction; however, this method is not feasible for long distances or for severely polluted materials. Currently, about 186,000 C.Y. per year are removed by hopper dredge. Material now being ocean dumped is exempt from chemical and bioassay testing because of its sandy nature. Bioassays and other tests in accordance with applicable portions of EPA's January 11, 1977 Ocean Dumping regulations would be conducted prior to the dumping of any material not meeting the exclusion criteria.

108.4 Special dredge and barges. A 1970 interim report on a long-range spoil disposal study by the U. S. Army Engineer District, Charleston, Corps of Engineers recommended the use of a special dredge and barges to move dredged material to offshore sites. This study was prepared for maintenance of Charleston Harbor, but the similar problems in Georgetown Harbor make the method equally applicable to Georgetown. As described in the report, "Maintenance of the navigation features by this plan would be in three steps as follows: (1) initial removal of the in situ shoal material by a special dredge; (2) direct pumping of

the dredged material into hopper barges located along side the dredge, and (3) conveying the material to sea by barges for disposal. The following major items of equipment will be required for continuous operation: special dredge, eight barges, two tenders, and two tugs." The cost of dredging by this method was calculated in 1970 to be $0.42/C.Y. This cost was updated in "Interim Review of Reports, Charleston Harbor, S. C.", October, 1974 to $0.68/C.Y., based on the following assumptions:

(1) The special dredge can handle 7,000,000 C.Y. of in situ material (equivalent to 11,600,000 C.Y. of dredged mixture) in 7,000 hours (2.8 C.Y./Min)

(2) Average density of in situ shoal material = 1300 gm/liter

(3) Average density of dredged mixture = 1150 gm/liter

(4) Average haul distance = 17 miles (one way)

(5) Average speed of tow and barges = 5 mi/hr

(6) Dumping time of barges = 10 min

The special dredge referred to above is one which pumps shoal material with a much lower water content than conventional hydraulic dredges. This makes the conveyance of dredged material to disposal sites economical without temporary storage for drying and without consequent additional costs. The special equipment needed, although in use in Japan and the Netherlands, is not currently available from Government plant or commercial companies in this country. The equipment could be made available well within the 50-year project life of this plan. Diked disposal areas, upland sites or marsh building sites could be used in the interim period. EPA and other state and federal agencies have stated a preference for offshore disposal, if the material being dumped meets applicable criteria. EPA does not presently have numerical criteria for all pollutants in dredged materials which can be applied to offshore disposal. As discussed in Section 1.08.3, any material which does not meet the exclusion criteria of the 11 January 1977 EPA Ocean Dumping regulations would undergo chemical and bioassay tests prior to dumping.

1.09.0 Location of disposal areas. Under existing authority, the local sponsor provides easements for disposal sites. The local sponsor, by signing a letter of intent, indicates the availability of disposal areas and his willingness to acquire them. These easements are provided on an as-needed basis. No authority exists to require the local sponsor to obtain easements or to define alternate sites any faster than the need for these disposal areas arises. The disposal areas shown in Plate 1 or the EPA approved offshore areas are those which will be used in the

near future. Upland sites, beach nourishment or increased ocean disposal as indicated in Plate 1-A will be used to handle material from new construction and increased maintenance activities.

1.09.1 In addition to the use of diked disposal areas as shown in plate 1, several experimental methods have been tried as part of a continuing effort to reduce the number and acreage of disposal sites. A program to create new marsh in Winyah Bay has been underway since 1974. In 1974, 238,554 C.Y. of material were pumped into a shallow open-water area of about 16 acres adjacent to Middle Ground. In 1975 and 1976 636,383 C.Y. and 628, 826 C.Y., respectively, were added. A silt barrier was used to trap small suspended particles that would increase the turbidity of adjacent areas. Some buildup was accomplished in 1975, and an estimated 2-3 acres of new Spartina marsh have been created. Before marsh building is expanded to a large scale effort, an examination will be made of the need for new marsh in each particular area and the value of the open water, bottoms and mudflats that would be replaced. The effect of building marsh on a large scale will also be examined. A marsh/shoal water area ratio of about 2:1 is given for the State of South Carolina. At this time the feasibility of this method has not been demonstrated sufficiently to consider it as a major method for disposal of dredged material.

1.09.2 Most of the materials dredged from the harbor during annual maintenance operations consist of silt and clay, and are not suitable for most construction and industrial purposes. Some of the more sandy soils have been used for fill or beach disposal. This limited use will continue in the future. New excavation for one of the deepening alternatives could provide more materials that would be suitable for beach nourishment. Use of the more plastic materials for admixtures in making bricks has been shown to be feasible, but not economically attractive when costs for transportation and processing are included. Dredged materials have been used for agricultural purposes on Cat Island. Materials from more saline areas could require treatment before they could be used for agricultural purposes. As yet, sufficient demand for these materials has not been demonstrated to consider these uses as a major alternative to upland or ocean disposal.

1.09.3 The Corps recognizes certain advantages of a long-term (50-year) plan to define future disposal areas, but is constrained by the lack of authority to require such a plan from a local sponsor and several disadvantages:

(1) If the local sponsor were to acquire disposal sites far in advance of actual need, and if the disposal of dredged material as planned were precluded by economic, ecological or any other consideration, the local sponsor would have a great deal of capital invested in unneeded property.

(2) Within the 50-year period, a method of disposal may well be developed which has far lesser environmental impact than the methods presently used or anticipated. The project should remain flexible enough to take advantage of new and better methods.

(3) A plan might be adopted without actually acquiring the land, but to announce in advance the location of all proposed disposal sites needed for fifty years of maintenance dredging would invite speculation and escalation of costs.

(4) At any time after the adoption of such a plan, some or all of the prospective disposal sites may become developed or used for some purpose which would be incompatible with their proposed use for disposal of dredged material.

109.4 The Corps can reject sites proposed by the local sponsor which it considers inadequate based on current needs and policy. Corps policy as defined in 33CFR209 and draft ER1105-2-XXX on water quality and wetlands discourages the use of wetlands as future disposal sites except in cases where no reasonable alternative is available and a need for the project exists.

109.5 Interagency coordination meetings and field trips as necessary prior to the selection of disposal sites are anticipated, similar to cooperative efforts on the Atlantic Intracoastal Waterway. These meetings would include EPA, U. S. Fish and Wildlife Service, South Carolina Wildlife and Marine Resources, and other cognizant agencies.

2.0 Existing Environmental Setting

2.01 General. The project area is a 40-square mile expanse of tidal water and land located near the southern tip of Georgetown County, approximately halfway between the North Carolina state line and Charleston, South Carolina. The main body of water, Winyah Bay, is a coastal estuary fed by watersheds of the Sampit, Pee Dee and Waccamaw Rivers. The bay is "S" shaped, about a mile wide at either end and approximately four miles wide in the curving center. It is dotted with islands (Marsh, Big Marsh, Pumpkinseed, Rabbit, Hare and Middle Ground) of natural and artifical origin. In addition to the ships docking at Georgetown, the upper half of Winyah Bay is also used by vessels and barges traveling on the Atlantic Intracoastal Waterway (AIWW). Georgetown Harbor freight traffic for 1975 is shown in Section 2.07.1.

2.01.1 Peripheral land within the boundaries of the project area includes parts of South Island, Cat Island, North Island, a broad

peninsula referred to as Waccamaw Neck and the mainland south of Georgetown. The only municipality located within the project area is Georgetown with a 1970 population of 10,449.

2.01.1.1 Hobcaw Barony is a 17,500 acre preserve which is located on the Waccamaw Neck peninsula. Miss Belle W. Baruch, willed the property and net returns from a trust fund to be used "....for the purpose of teaching and/or research in forestry, marine biology, and the care and propogation of wildlife and fauna in South Carolina in connection with the colleges and/or universitites in the State of South Carolina." A long-term tripartite contract permits Clemson University to manage the forest-marine areas and the University of South Carolina to manage the marsh-estuarine areas for the Belle W. Baruch Foundation. The Forest Science Institute of Clemson and the Institute for Marine Biology and Coastal Research of U.S.C. maintain facilities and active research on the forest types, fresh water swamps, former rice fields, salt marshes, estuarine waters, estuarine islands and barrier island which comprise this preserve. This site has received extremely high ratings by a national Site Review Panel for its use as an experimental reserve based on its relatively undisturbed nature, diversity and contiguity.

2.01.1.2 Thomas A. Yawkey Property. In his will, Mr. Thomas Yawkey made provisions for portions of North Island, South Island and Cat Island to be managed by the State of South Carolina as a wilderness area and game preserve. A total of 15,000 acres is to be preserved for these purposes and a ten million dollar trust fund is to provide financial support. The will states that "....North Island is to be held and used for all time as a wilderness area. No permanent structure, human habitation or roads permitted except those necessary for protection and management of the property...no change of primitive wilderness character permitted." South Island is to be held for "....the protection and feeding of waterfowl and no hunting and shooting allowed. No general recreation activities allowed". The remainder of the property is to be "....dedicated, held and used for a wildlife management area for migratory birds of all kinds, administered by the Wildlife and Marine Resources Department." The overall area has been described by the executive director of the Department as "unsurpassed anywhere in the coastal area."

2.01.1.3 Estherville Plantation is located on the southwestern shore of Winyah Bay. The property, owned by the Parker Corporation, was formed from Winyah Barony holdings in the mid 18th century. Although the house was built in the early 20th century, the plantation grounds are of historical interest because of their role in early rice cultivation. It is possible that Estherville Plantation was the first to use tidal flow to inundate former river swamp for rice cultivation as early as 1758; however, some think that this distinction belongs to an area on the North Santee or farther up Winyah Bay. On 9 August 1976 Estherville was submitted to the State Historic Preservation Officer for consideration by him for nomination to the National Register of Historic Places. As

of the date of this writing, the SHPO has not made a determination concerning the significance of the property or its eligibility for the National Register.

2.01.1.4 Belle Isle is a combination resort and residential development about five miles south of Georgetown. The 140 acre site includes condominiums, a marina, a golf course and several other sports facilities. The area has been altered by the increase in population, housing and other facilities, and is man-dominated; however, much of the natural setting has been retained.

2.02 Hydrology. Georgetown Harbor is located in the protected waters of Winyah Bay, specifically in the Sampit River tributary. Winyah Bay is composed of the mouths of several major streams arising in South Carolina and North Carolina. The Great Pee Dee and Little Pee Dee Rivers merge north of Georgetown and with the Waccamaw form the headwaters of Winyah Bay. The Little Pee Dee and Waccamaw Rivers, with a combined drainage area of about 16,340 square miles, drain extensive swamp areas in northeastern South Carolina and southeastern North Carolina as evidenced by the "black water" nature of the streams. The Black River contributes water from another major South Carolina watershed. Sampit River, a small stream confined mainly to Georgetown County, flows into the bay south of Georgetown. The South Carolina State Ports Authority docks are located on the Sampit River near its confluence with Winyah Bay. Shoaling in this area is very high, as shown in the following annual average shoaling rates:

Sampit River	1,323,000 C.Y.
Upper Winyah Bay	652,000 C.Y.
Eastern Channel	283,000 C.Y.

2.02.1 Winyah Bay is designated as Class SC waters by the South Carolina Department of Health and Environmental Control: waters suitable for crabbing, commercial fishing and other uses except bathing or shellfishing for market purposes, or for uses requiring water of lesser quality. This classification extends from Winyah Bay entrance to the U. S. 17 bridge on the Waccamaw River arm, and in the Pee Dee River arm to near the mouth of the Black River and is the lowest water quality classification for saline waters. Saline waters of the Sampit River are also designated as Class SC. The Pee Dee upstream and the Black River (saline reaches only) are designated as Class SB: waters suitable for bathing and any other usages except shellfishing for market purposes, and for uses requiring water of lesser quality.

2.02.2 The saline waters of the Waccamaw upstream of the U. S. Highway 17 bridge are designated as Class SA, the highest classification of

saline waters in South Carolina: waters suitable for shellfishing for market purposes and any other usages and for uses requiring water of lesser quality.

2.02.3 Georgetown Harbor receives treated municipal wastes from Georgetown's oxidation-pond treatment facilities and treated industrial wastes from the International Paper Corporation and Georgetown Steel Company.

2.02.4 Sampling for pollutants in Winyah Bay.

2.02.4.1 In August 1971, the Environmental Protection Agency analyzed sediment samples taken from Georgetown Harbor. Chemical analyses of the samples were conducted to determine total organics, volatile solids, trace metals, etc. Results of these analyses are presented in Appendix A. Lead and zinc concentrations at several locations were greater than the numerical standards then in effect. These numerical standards have been rescinded and no new numerical standards for sediments have been formulated in their place. Oil and grease were close to or in excess of numerical standards then in effect.

2.02.4.2 Since 1971, more stringent effluent controls have been imposed on point source discharges into Winyah Bay. This is a factor contributing to the much lower concentrations of most metals and oil and grease in new sediment samples taken by the Corps of Engineers in April 1977. The results of these analyses are included in Appendix A. Markedly lower levels of oil and grease, lead, zinc, copper and chrome were measured by the new analyses while levels of volitile solids, C.O.D., Kjeldahl nitrogen and total phosphorus were roughly similar for both studies. In addition to sediment analysis, the April 1977 investigation approximated the availability of the sediment pollutants to the water column by elutriate tests, also included in Appendix A. In most cases the concentration of metals in the elutriate was less than the concentration of metals in the receiving waters. The adhesion to clays and other silicate surfaces has been shown to reduce metal levels in other studies. Concentration of organics and nutrients in the elutriate, as would be expected, were higher than in the receiving water. No numerical standards for ocean or estuarine waters are available from EPA or the South Carolina Department of Health and Environmental Control with which to compare the measured concentrations. Based on the concentrations listed in EPA publication 440/9-76-023, "Quality Criteria for Water," neither the sediments nor receiving waters are severely polluted by the substances sampled.

2.02.4.3 Water samples taken by the South Carolina Department of Health and Environmental Control in 1975 at Sampit Channel, Hare Island, Mud Bay, Western Channel, and Mosquito Creek showed that levels of lead in the water column varied between 0.002 and 0.004 ppm, and levels of zinc varied between 0.02 and 0.04 ppm. No oysters were found in these areas.

In Town Creek and Jones Creek, lead concentrations in water were 0.001 and 0.002 ppm, respectively, and zinc concentrations were 0.05 at both locations. Concentrations of lead in the meats of oysters taken from Town Creek and Jones Creek were 0.37 ppm and 0.20 ppm, respectively. Zinc in oyster meats from these same locations was 142.3 ppm and 152.6 ppm, respectively, well below standards set by FDA for edible shellfish.

2.03 Geology. The geologic history of the Coastal Plain of South Carolina has been marked by uplift and erosion of the land and a rise and fall of the sea. Obscured by surface sands, the underlying rock formations consist of sands, clays, marls and limestones formed by sedimentation in shallow marine environments. The basal stratum overlying older crystalline rock is the Tuscaloosa formation. The Tuscaloosa formation is overlain by the younger Black Creek formation consisting of gray to black clays and thin beds of gray to white slightly glauconitic sand. The Black Creek formation is overlain by the Pee Dee formation consisting chiefly of dark green or gray, glauconitic and argillaceous sands and impure limestones. Sediments which cover the Pee Dee formation are marine in origin and the line of demarcation between the Cretaceous Period and the Tertiary Period is largely based on the paleontological evidence of fossils. The eastern half of Georgetown County is covered by deposits of Pleistocene and recent age, consisting of sand, clay, shell and marl material. Borings to a depth of 42 feet local mean low water show that in the reach above Station 800+00, either shale or limestone is first encountered at approximately 30 feet. Below Station 800+00, rock was encountered in one boring.

2.04 Soils. In Georgetown County, the soils have developed from nearly level beds of unconsolidated sands, silts, clays and soft limestones. Drainage varies from moderately to very poorly drained. A map of soil limitations is included as Figure 1. A summary of soil types found in the project area is included as Appendix B.

2.05 Climate. The climate of the Georgetown area is mild, partly as a result of the moderating effect of the nearby Atlantic Ocean. The mean annual temperature in the basin is about 63°F. The frost-free growing season averages 230 days. The first freeze occurs around the first of December and the last freeze near the end of March. Precipitation is well distributed throughout the year with an average amount of 50 inches. Percentage of precipitation by season is as follows: 21% winter, 25% spring, 37% summer and 17% autumn. Low pressure areas moving northeast along the coast bring heavy amounts of rain and rarely snow during the winter months. During the late summer or fall months, hurricanes occasionally reach the South Carolina coast. Heavy precipitation usually occurs in the Georgetown area during these storms. More than eight inches of rainfall associated with the hurricanes of September 1924 and October 1964 was recorded at the Georgetown weather station.

2.06 Biological resources. The existing setting for all areas which might be affected by each of the alternative actions is described

below. To facilitate this description, the project area has been divided into six general habitat classifications, the impacts on which are discussed in Section 4. To determine the setting of a specific location, maps with vegetation, land use and other features are included as Plates 4 through 10. By consulting both the maps and the discussion of general habitat types, the existing setting can be determined for any small area, as well as the overall project area.

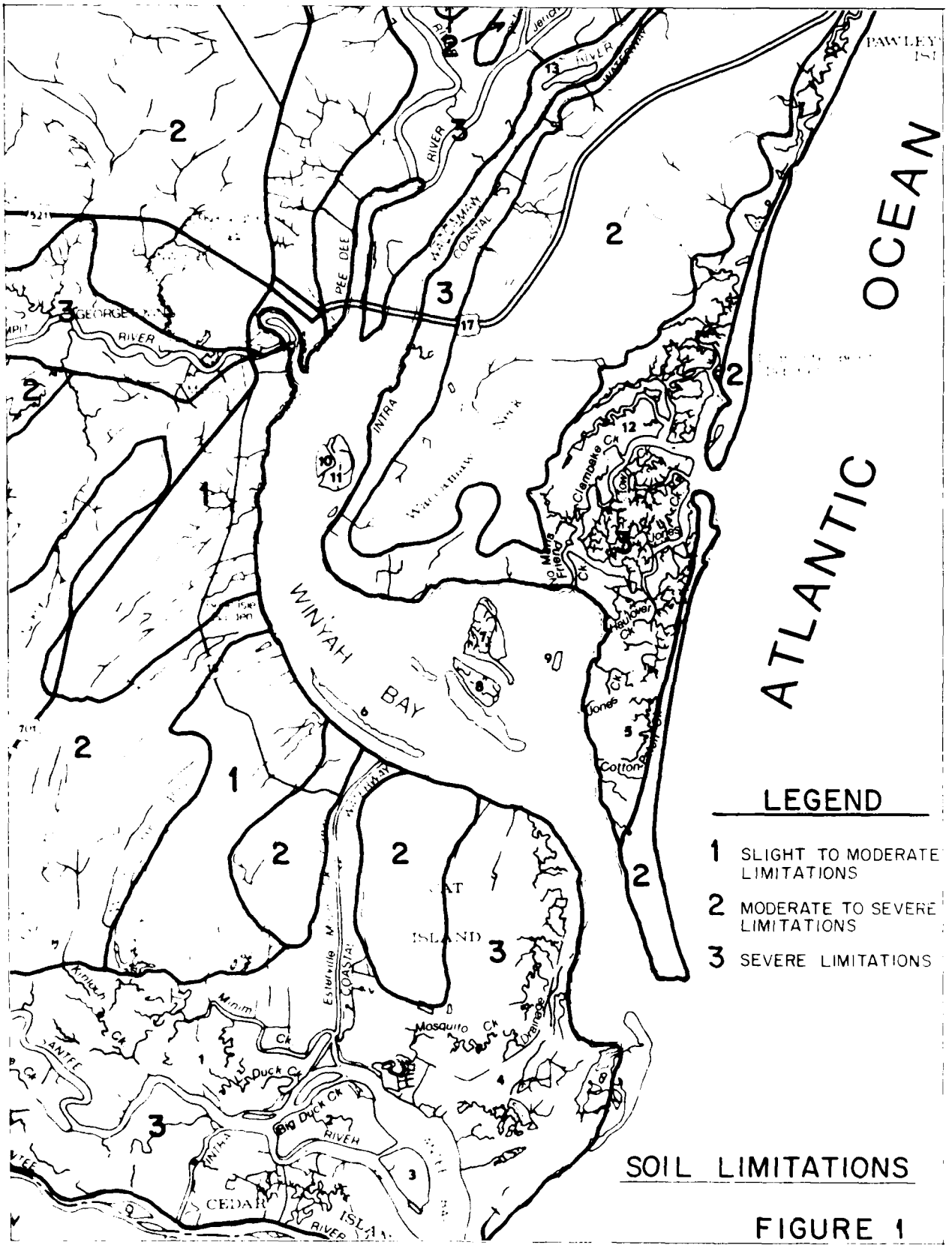
2.06.1 Open water. The open water community, as defined here, includes all marine and estuarine waters together with all underlying bottoms below the intertidal zone. The open water biota includes the plankton and nekton inhabiting the water column and the benthos living on or in the substrata. The plankton is mainly composed of unicellular algae, larval stages of many fish and invertebrates and the adult stages of several microscopic invertebrates. Larger forms, such as jellyfish and comb jellies which are carried by currents and tides are also included in the plankton.

2.06.1.1 Fish are the principal nektonic species, although some crustaceans such as portunid crabs, amphipods and isopods and some mollusks, such as the squid, spend at least a portion of their life as nekton. A number of the fish species including many of importance to the sport and commercial fishery, are considered to be estuarine dependent and utilize the estuary for at least a portion of their life cycle. Included are menhaden, anchovy, spot, croaker, spotted seatrout, red drum, mullet, flounder, striped bass, herring, shad, black sea bass, and others. In addition, many species commonly associated with the open ocean such as sharks, mackerels, tunas, and bluefish occur around the entrance channel.

2.06.1.2 The benthic environment includes a number of communities largely correlated with substratum type. Macroscopic algae and angiosperms are found wherever there is suitable substrate, however, because of the predominately sandy substrate along the South Carolina coast, habitat for these species is not abundant. Sea lettuce (Ulva sp.) is common to the area. The occasional occurrence on beaches of marine algae such as sargassum, Enteromorpha, Codium, Dasya, Chondria, Porphyra, Gracilaria, and Ectocarpus is due to the activity of storm waves on offshore areas.

2.06.1.3 The benthic invertebrate diversity in the area does not vary to any significant degree within the boundaries of the project area. Distribution of these organisms is, however, affected by bottom types, salinity, and degree of pollution. Benthic invertebrates present in the open water community include pelecypod and gastropod mollusks, crabs, amphipods, polychaete worms, flat worms, round worms, shrimp, isopods, and others. Many of these organisms are preyed upon by animals harvested in the commercial and sport fishery.

2.06.1.4 Commercial and sport fisheries in the upper reaches of Winyah Bay are marginal from the Sampit Channel to Frazier F[illegible] due to domes-



SOIL LIMITATIONS

FIGURE 1

tic and industrial pollution originating in the Georgetown area. The areas below Frazier Point are heavily utilized for recreation, and sport and commercial fisheries. Although oysters are present, the project area is Class SC water and is, therefore, closed to shellfish harvesting. Oysters and clams are harvested from North Inlet; however, investigations published July 1973 by the Department of Geology, University of South Carolina show that North Inlet does not receive water from Winyah Bay except under an unusual combination of weather conditions. The main commercial species landed are the penaeid shrimps. A summary of commercial landings for the period 1969-1974 is presented in Table 2. The main sport fishes taken from the inshore waters are trout, red and black drum, sheepshead, spot, and croaker. Above the turning basin in the Sampit Channel, largemouth bass, bream, crappie, catfish, and carp contribute to the sport fishery (Reference 1).

2.06.1.5 The bottle-nosed dolphin, and the diamondback terrapin may be found in Winyah Bay throughout the year. The loggerhead turtle is most likely to be found in limited numbers in the harbor area during the spring and summer. There are a variety of birds frequently seen in the harbor area, including some that are also common to other environments. The brown pelican, black skimmer, royal tern, red breasted merganser, and scoters are normally found only in the ocean or in connecting marine areas such as Georgetown Harbor. The herring gull, laughing gull, ringbill gull, osprey, double crested cormorant, lesser scaup, and the common loon are commonly seen in the harbor area as well as various freshwater habitats.

2.06.2 Beach and dune. Most of the coast is bordered by a narrow beach and dune comprised mainly of sand and shell fragments. This habitat is dry because of rapid percolation and contains salts derived from the ocean. This type of habitat is represented in the project area by the two sand bars obstructing the mouth of Winyah Bay and by relictual beach on the eastern side of South Island. The characteristic vegetation of this community is sea oats, but other plants commonly found include salt meadow cordgrass, pennywort, sandspurs, marsh elder, sea rocket, yaupon, red cedar, and live oak. In the Georgetown area, red cedar is abundant on the more protected sides of the dunes. On the old beach on South Island, most of the grasses have been replaced by red cedar, loblolly pine, and wax myrtle which appear to be pioneering in this community. Succession by tree species in the area fronting on the ocean is checked by the influence of salt spray, occasional flooding, and shifting sands.

2.06.2.1 The seemingly barren beach community supports a wide variety of animal life. Macroinvertebrates, the predominant faunal organisms inhabiting this zone, live beneath the sand surface where salinities and temperatures are more constant. Most of these organisms are filter or deposit feeders and the greatest concentrations are found in the inter-

[illegible]

	[illegible]		[illegible]		[illegible]		[illegible]		1971		1970	
Finfish	Pounds	Dollars	Pounds	Dollars	Pounds	Dollars	Pounds	Dollars	Pounds	Dollars	Pounds	Dollars
Alewives		-				-		-	150,000	3,000	20,000	300
[illegible]	5,115	68	150	51	3,100	613	-	-	17,875	2,331	8,350	1,251
[illegible]	-		56,000	5,600	100	15	83	16	500	50	2,050	187
Drum, black	-	-		-	144	21	158	32	200	35	1,000	100
Drum, red	-	-	125	30		-	-	-	100	20	-	-
Eels, common	-		-	-	1,300	355	-	-	-	-	-	-
Flounders, unclassified	3,262	1,157	2,503	2,113	9,387	2,517	5,890	1,181	6,310	1,387	1,500	240
Groupers	16,555	9,580	60,856	31,255	66,433	24,067	9,147	2,015	3,920	552	3,200	315
Grunts	139	21	-		3,500	330	775	1,591	1,250	125	3,200	260
Hickory shad	1,344	553	-	-	-	-	3,186	637	-	-	1,100	203
King mackerel	7,667	3,500	4,069	2,287	10,455	4,482	778	357	6,350	1,108	-	-
King whiting or "Kingfish"	7,118	1,415	11,455	1,755	24,255	4,081	15,935	1,814	22,800	2,628	8,000	845
Menhaden	-	-	-	-	-	-	-	-	12,000	240	10,000	100
Mullet	677,693	69,295	840,693	-	239,935	26,690	508,900	22,794	673,750	34,739	859,000	17,180
Pompano	-	-	-	-	632	143	-	-	-	-	-	-
Scup or porgy, unclassified	11,888	4,095	2,819	727	18,559	3,757	15,107	3,338	121,500	12,300	239,118	24,442
Sea bass, unclassified	74,858	23,201	21,857	7,233	120,154	38,211	290,786	100,654	329,030	77,216	497,381	104,622
Seatrout, gray	433	167	1,800	696	1,823	559	-	-	-	-	3,700	308
Seatrout, spotted	1,250	583	1,322	566	2,060	674	7,995	2,390	19,923	4,944	4,700	1,175
Shad	50,091	29,229	21,799	10,925	25,318	11,312	116,223	34,195	80,086	31,328	93,626	26,269
Sharks	365	80	-	-	4,258	421	-	-	400	32	-	-
Sheepshead, saltwater	-	-	-	-	-	-	-	-	-	-	-	-
Snapper, Red	2,908	2,916	8,289	8,698	11,091	10,194	7,060	5,713	3,500	2,415	8,500	5,950
Snapper, Vermillion	892	588	1,750	918	4,878	2,302	11,221	4,521	9,850	3,188	-	-
Spanish mackerel	1,860	713	1,152	263	2,300	331	910	215	2,950	369		-
Spot	1,459,553	248,966	338,593	37,821	1,403,592	227,000	2,223,855	201,988	1,239,090	78,411	342,400	34,422
Sturgeon	67,483	22,755	56,537	19,780	54,365	13,178	68,019	18,208	76,499	14,672	3,808	762
Tilefish	176	70	-	-	-	-	-	-	-	-	-	-
Unclassified for Food	198	30	-	-	-	-	-	-	-	-	-	-
Total Finfish	2,387,872	420,164	1,406,848	128,716	1,998,976	371,322	3,286,428	401,659	2,772,783	281,079	2,110,633	218,926
SHELLFISH												
Crabs, Blue, hard	53,272	8,305	22,440	3,970	92,499	12,701	7,505	931	2,675	253	4,400	308
Shrimp, saltwater (heads-on)	1,226,953	1,473,617	888,821	533,906	1,193,533	1,352,225	745,296	475,466	955,220	496,428	476,672	262,213
Clams, Hard (meats)	11,147	13,377	9,481	8,951	14,769	7,347	16,730	7,360	256,210	118,533	23,600	10,620
Octopus	-	-	-	-	1,000	150	-	-	-	-	-	-
Oysters (meats)	48,593	25,582	62,876	33,506	56,137	29,662	38,675	19,180	39,299	19,420	32,542	16,573
Squid	215	65	712	221	1,347	202	-	-	-	-	-	-
Total Shellfish	1,340,180	1,520,846	984,330	587,362	1,359,285	1,402,287	808,206	502,937	1,253,404	634,634	537,214	289,714
Grand Total	3,728,052	1,941,010	2,391,178	716,178	3,358,261	1,773,609	4,094,634	904,596	4,026,187	915,713	2,647,847	508,640

1/Includes Georgetown, Horry, and Marion Counties
(From: S. C. Landings, Annual Summaries, U. S. Dept of Commerce in cooperation with the S. C. Wildlife and Marine Resources Dept.)

tidal zones where there is a concentration of particulate organic matter brought in by the tides or supplied by the decomposition of animals on the beach. Typical inhabitants of the beach community are beach fleas and ghost crabs in the beach berm; wedge shells, mole crabs, and various burrowing polychaete worms in the intertidal zone; and blue crabs, horseshoe crabs, sand dollars, and numerous pelecypod and gastropod mollusks in the beach subtidal areas. The beach zone is utilized by numerous shore birds for nesting and feeding. Species commonly observed are the American oyster-catcher, plovers, willet, sandpipers, lesser and greater yellowlegs, and gulls and terns.

2.06.2.2 The dune community is somewhat limited in importance to wildlife due to its rather sparse vegetative cover and insufficient food supply. Ghost crabs, tiger beetles, dragonflies, seaside and Ipswich sparrows, barn swallows, six-lined racerunners, Eastern glass lizards, and Eastern slender glass lizards are characteristic inhabitants. Visiting mammals such as raccoons, opossums, and rabbits may also be found in this area.

2.06.3 Marsh. Most of the intertidal area of Winyah Bay including most of South Island, the landward portions of North Island, and the banks of the lower reaches of the tributaries to Winyah Bay is comprised of marsh. The vegetation in these marshlands varies with elevation and salinity but is generally dominated by emergent, narrow-leaved rushes, sedges and grasses. Soils are generally poorly drained peats and mucks and anaerobic conditions are usually present beneath the ground surface. The tidal marshes in the project area can generally be separated into low marsh and high marsh. There is also an area of fresh marsh located on the northern side of Winyah Bay.

2.06.3.1 Low marsh is the lowest, topographically, and occurs from mean sea level to about mean high water. This region is regularly flooded by lunar tides and is vegetated primarily with smooth cordgrass throughout most of Winyah Bay. In areas of lower salinity the smooth cordgrass becomes less abundant and is replaced by less salt-tolerant species such as big cordgrass, bulrush, cattail, wild rice, and duck potato. In the higher reaches of this zone, black needlerush and glasswort can be found with or instead of the cordgrass.

2.06.3.2 High marshes are those marshes situated at elevations above the normal high tide level but within the area flooded by spring tides. In Winyah Bay, this community consists of a rather narrow fringe above the low marsh and rather large areas of South and North Islands and other islands within the bay. Black needlerush is the principal plant found in the high marsh areas of Winyah Bay. Sea ox-eye, salt meadow cordgrass, and silverling tree are locally abundant in this type of marsh. Further upstream in Winyah Bay, black needle rush gives way to other plants such as salt reed-grass, giant reed, duck potato, and bulrush. Especially conspicuous is salt reed-grass which is abundant on

several of the small islands and on Middle Ground near the junction of the bay with the Atlantic Intracoastal Waterway (AIWW). Giant reed occurs in stands reaching a height of 20 to 30 feet along the south margin of the bay especially in the vicinity of the AIWW. High marsh also occurs in sites previously used for the cultivation of rice. The principal species of plant life in these former rice fields are wild rice, reed, bulrush, cattail and duck potato.

2.06.3.3 Winyah Bay also has several islands and upland areas which were created when material dredged during the construction and subsequent maintenance dredging of the harbor was deposited on adjacent marshes or in open water areas. The marsh disposal sites have been diked in recent years to prevent the spread of dredged material beyond the disposal area. Silverling tree and poke berry are usually the first plants to appear after each use of these diked areas and they quickly form a dense ground cover. These plants are killed if covered to a sufficient depth during subsequent dredging operations but quickly become re-established. Open water disposal is no longer used in the harbor, except for the marsh building field trial at Middle Ground. The old circular deposits built up during former open water disposal operations have been washed and leached by rains, leaving medium-grained sands on the highest portions which are essentially bare of vegetation. The first vegetation encountered while moving away from the center of these mounds is a sparse covering of grasses, which gradually gives way to shrubs and vines, then a circle of pines or red cedar, surrounded by marshland along the intertidal portions.

2.06.3.4 The fresh water marsh is represented by a small community located on the northern side of Winyah Bay within an oak-pine forest on the wide peninsula of land comprising the major portion of the Baruch Plantation. The origin of this marsh is unknown, but it may be the remnants of a Carolina bay, which is a geologic formation peculiar to and very abundant in Georgia and North and South Carolina. The surrounding forest vegetation is invading the marsh site with cypress trees and seedlings as well as mesophytic species such as sweetgum, black gum, and red maple. Shrubs are also present around the border with the most common species being hollies, blueberries, fetterbush, wax myrtle, titi, and catbrier. Vegetation within this marsh includes herbs such as lizard's-tail, cattail, golden club, arrowhead, manna grass, false loosestrife and many other species of annual plants.

2.06.3.5 Estuarine marsh communities. These communities have been well documented in terms of productivity, animal diversity and importance of these associated marsh communities involves the basic high productivity of the marsh itself, and its function of trapping nutrients from the upland communities. The detritus deposited each year when the Spartina dies and decomposes provides a food base upon which the estuarine organisms thrive. The dense plant growth in the marsh provides excellent cover for many species of birds, aquatic and semi-aquatic mammals,

reptiles and amphibians. Substrates in these communities are inhabited by a myriad of foraminiferans, nematodes, annelids, arthropods, and mollusks. The marsh community provides a nursery ground for the principal commercial marine organisms of the state; white and brown shrimp and blue crabs. These and the young of many other sport and commercial species move in the out with the tide to feed around the stems of the marsh grass.

2.06.3.5.1 Throughout these marsh communities numerous shorebirds, waterfowl, gulls, herons, and egrets will be found. Birds such as plovers, dowitchers and sandpipers thrive on the benthic invertebrate population around the shoreline and on open flats. In the open water bordering these communities, waterfowl will be found feeding on vegetation or small marine fishes and free swimming invertebrates. Another game bird to be found is the clapper rail, a permanent resident of of these marshes. The herons and egrets feed on fish, invertebrates, reptiles, amphibians, and small mammals in the marsh. They also are found nesting and roosting during the summer months. Many gulls will be found the year around utilizing these communities for resting and scavenging. Other birds such as the red-winged blackbird, common and boat-tailed grackles, sparrows, and warblers will be found nesting and feeding on insects and grains. Birds of prey such as osprey, bald eagle, and marsh hawk will also be found utilizing these communities to some degree.

2.06.3.5.2 Mammals of the marshes typically include the raccoon, otter, rice rat, opossum and marsh rabbit. The raccoon and opossum are ubiquitous animals and opportunistic feeders. The otter thrives on crustaceans and fish while the rice rat and marsh rabbit are herbivores. On occasion, other mammals such as the bobcat and fox will visit these communities.

2.06.4 Woodlands. Woodlands within the project area consist of cypress swamp in the lowest, wettest areas and oak-pine forest on higher sites.

2.06.4.1 Cypress swamps are scattered throughout the area adjacent to Winyah Bay, especially along fresh water tributaries, the headwaters of fresh water ponds, and in the depressions between former beach dunes. Other trees found in cypress swamps are sweetgum, tupelo gum, black gum, and red maple. Within the fringe of the cypress swamp community there may be a very thick shrub ecotone which contains small trees such as red bay, sweet bay, and shrubs such as fetterbush, wax myrtle, bitter gallberry, titi, sweet pepperbush, and highbush blueberry.

2.06.4.2 The oak-pine forest which occupies the higher sites varies considerably in the project area. A mature live oak forest is located

on the west side of Winyah Bay across from the Coast Guard Lighthouse. Interspersed among these live oaks are cabbage palms and magnolia. The narrow forest zone which occurs along the beach and dune communities on the east side of Winyah Bay is comprised of live oaks and shrubs which are sheared by salt spray into a sloping, undulating canopy. Landward of this area the forest is composed primarily of loblolly and longleaf pine. The ridges of former dunes found on the southwest side of Winyah Bay and west of the AIWW are occupied by forests consisting mainly of longleaf pine and turkey oak, with some loblolly pine and blackjack oak. On the north side of Winyah Bay, the terrain is low and is covered by a forest of cypress and sweetgum in addition to live oak, loblolly pine, and longleaf pine. The understory of the oak-pine forests includes wild black cherry, sassafras, persimmon, wax myrtle, various blueberries, laurel cherry, and herbs such as broomsedge, goldenrod, wiregrass, golden aster, partridge berry, Spanish moss, mistletoe, poison ivy, and catbrier.

2.06.4.3 The oak-pine forest, cypress, and freshwater marsh communities are integrated with cypress and freshwater marsh communities appearing as pockets within the oak-pine forest. Similarities between the animal composition of the cypress and freshwater marsh, with few exceptions, are great. The majority of the terrestrial animals in the project area will utilize these communities as a whole, especially the larger game animals and predators.

2.06.4.4 Game animals such as the white-tailed deer range throughout the community feeding on acorns, fungi, grasses, twigs, and shrubs. Smaller game animals such as the fox squirrel and bobwhite use the more open pine areas, the former feeds on pine seeds, acorns, and fungi; the latter on grass seeds, berries, and insects. Gray squirrels inhabit the oak-pine and cypress communities and they feed on acorns, nuts, berries, and fungi. Black bear, feral hogs, and turkey could be found ranging throughout these communities. Predators such as the fox, bobcat, owls, hawks, and snakes range through all of these communities.

2.06.4.5 The edges of the cypress swamp and freshwater marsh are utilized by mammals such as the marsh rabbit, rice rat, and starnosed mole which are typical of these communities. Reptiles and amphibians utilizing these two communities are the alligator, black swamp snake, water snakes, eastern cottonmouth, bullfrog, and leopard frog. The cypress swamp and freshwater marsh will attract birds such as the great blue heron, cattle egret, wood ibis, and white ibis. Not only will these birds feed in and around these communities, but they also roost in the cypress swamp. The wood duck, a permanent resident and game species, will be found in both of these communities. The blending of these communities provides a variety of habitat, cover, and food which promotes a high species diversity of animals, thereby making this area highly attractive for wildlife habitat. In addition, it provides an important recreation area for man.

2.06.5 Agricultural. Several cleared tracts of land around Winyah Bay are planted to either truck crops or wildlife food and cover plantings. Rice was formerly an important crop and a large area of marshland on South Island and the east side of Winyah Bay was diked for the culture of rice. Maintenance of the peripheral dikes of some of these rice fields has been discontinued and the fields have reverted to marsh and/or cypress swamp. However, many dikes around old rice fields on the Belle Baruch Plantation, which includes most of the project area on the east side on Winyah Bay, continue to be maintained to provide waterfowl habitat.

2.06.5.1 Fields that are left fallow after harvest provide habitat for small mammals, birds, reptiles, and amphibians, and hunting grounds for birds of prey. The cotton rat, house mouse, and oppossum, for instance, are permanent residents, while the eastern kingbird, indigo bunting, and palm warbler are temporary foragers.

2.06.6 Urbanized. Urbanized areas in the vicinity of the project include parts of Georgetown and Maryville. Live oaks and loblolly pine are the most abundant trees and many varieties of domesticated plants such as azaleas and camellias are cultivated.

2.06.6.1 The man-dominated community provides habitat to those animals that easily adapt to man's habit and habitations. The gray squirrel, flying squirrel, opossum, and many birds easily adapt to man's presence. The black rat, the Norway rat, and the house mouse live in close association with man. Lizards and amphibians which are capable of using habitats with either natural and/or introduced vegetation are also found.

2.06.7 The following species are listed as endangered in the 14 July 1977 list by the U. S. Department of Interior. For the project area, these species include those also cited in lists of the State of South Carolina and the National Marine Fisheries Service.

2.06.7.1 Fish

Shortnose sturgeon	Acipenser brevirostrum

The shortnose sturgeon was a resident of Atlantic seaboard rivers from New Brunswick to Florida; however, most recent records are from the Hudson River.

2.06.7.2 Reptiles

American alligator	Alligator mississippiensis
Atlantic leatherback turtle	Dermochelys coriacea

The alligator is commonly observed in freshwater rivers and lakes. The leatherneck turtle might be present near the mouth of Winyah Bay.

2.06.7.3 Birds

Eskimo curlew	Numenius borealis
Southern bald eagle	Halialetus l. leucocephalus
American pergrine falcon	Falco peregrinus anatum
Brown pelican	Pelecanus occidentalis
Bachman's warbler	Vermivora bachmanii
Kirtlands warbler	Dendroica kirtlandii
Red-cockaded woodpecker	Dendrocopos borealis

The eskimo curlew peregrine falcon, Bachman's warbler and Kirtlands warbler are transient species. The southern bald eagle is a permanent resident of the state: three active nests are within five miles of the project - two on South Island and one on North Island. The brown pelican is a commonly observed resident of the Winyah Bay area and nests in many areas. The red-cockaded woodpecker is a resident of old-age pine woodlands and is the subject of a research study at Hobcaw Barony.

2.06.7.4 Mammals. The eastern cougar, Felis concolor cougar is listed as endangered in the eastern United States; however, there is little likelihood that any are present in the project area.

2.06.7.5 Plants. Four species found in Georgetown County (Radford, Ahles and Bell) are listed as threatened in House Document No. 94-51, 94th Congress, "Report on Endangered and Threatened Plant Species of the United States." Smithsonian Institution, 1975.

Species	Habitat
Dianaea muscipula	wet, sandy ditches, bog margins
Litsea aestivalis	pond and swamp margins, wet woodlands
Calamovilfa brevipilus	bogs and savannahs
Sarracenia rubra	bogs and savannahs

In addition to the above plants, seven others are listed in an interim list prepared by the U. S. Department of Agriculture, Soil Conservation Service, September 1976.

2.07 Economic Development. Economic development in the project area has shifted in emphasis from agriculture to heavy industries in recent years. Crops still grown in the Georgetown area are corn,

soybeans, and tobacco. Industries in Georgetown include paper and steel mills, chemical plants, commercial fishing and lumber and pulpwood yards, all users of the port or channel. Increased interest has been indicated for industries in the area south of the Sampit River where Santee Cooper is constructing a 280,000 kw coal-fired steam power plant. The following table presents data on employment.

EMPLOYMENT BY TYPE, GEORGETOWN COUNTY

1960 and 1970

	1960	1970	Change Net	Change %
Manufacturing	2,910	4,300	+1390	47.8
Wholesale and Retail Trade	1,070	1,450	+ 380	35.5
Government	1,090	1,150	+ 60	5.3
Services	750	750	0	0
Transportation, Communications, and Public Utilities	220	200	- 20	-9.1
Finance, Insurance, and Rural Estate	100	200	+100	100.0
Contract Construction	160	150	- 10	-6.3
Agriculture	1,490	800	-690	-46.3
Other	1,805	2,150	+345	19.1

Source: South Carolina Employemnt Security Commission, South Carolina's Manpower in Industry, 1961 and 1971.

2.07.1 Port of Georgetown. In 1975, the port handled approximately 1.4 million short tons of waterborne commerce. Commerce moved by barge traffic over the Atlantic Intracoastal Waterway or between points within the harbor accounted for 817,492 short tons or 60 percent of the total commerce. The remaining 40 percent (542,205 short tons) was transported by ocean-going vessels. The principal commodities passing through the port are pulpwood logs, iron ore and concentrates, residual fuel oil, paper and paperboard, and various iron products. Table 3 breaks down movement of goods by commodity and type of shipping.

3.0 Relationship of the Proposed Action to Land Use and Zoning. Land use of North Island and South Island and Cat Island was discussed in Sections 2.01.1.1 and 2.01.1.2. Land use in areas on the Western shore of Winyah Bay was discussed in Sections 2.01.1.3 and 2.01.1.4 and is indicated in Figures 4-10, and Georgetown County zoning maps are shown on Figures 11, 12, and 13. The following summary indicates the

COMPARATIVE STATEMENT OF TRAFFIC

YEAR	TONS	PASSENGERS	ADDITIONAL THROUGH TRAFFIC (TONS)	YEAR	TONS	PASSENGERS	ADDITIONAL THROUGH TRAFFIC (TONS)
1966	1,093,609	122	494,458	1971	1,190,637	40	460,534
1967	1,168,101	39	538,271	1972	1,524,102	6,252	571,588
1968	1,253,062	---	647,223	1973	1,485,731	500	490,884
1969	1,265,900	5	534,607	1974	1,619,986	422	488,770
1970	1,172,531	7	571,010	1975	1,359,697	242	412,576

FREIGHT TRAFFIC, 1975
(SHORT TONS)

COMMODITY	TOTAL	FOREIGN		DOMESTIC			
				COASTWISE		INTERNAL	
		IMPORTS	EXPORTS	RECEIPTS	SHIPMENTS	RECEIPTS	SHIPMENTS
TOTAL	1,359,697	257,143	159,145	88,192	37,725	798,491	19,001
0912 SHELLFISH, EXCEPT PREPARED	1,259	---	---	507	---	752	---
1011 IRON ORE AND CONCENTRATES	499,167	143,014	---	17,000	---	331,364	7,789
2415 PULPWOOD, LOG	419,159	---	---	---	---	419,159	---
2421 LUMBER	28	---	28	---	---	---	---
2511 FURNITURE AND FIXTURES	8	---	8	---	---	---	---
2631 PAPER AND PAPERBOARD	79,360	---	78,673	---	---	---	687
2691 PULP AND PAPER PRODUCTS, NEC	2,839	---	---	---	---	---	2,839
2819 BASIC CHEMICALS AND PROD, NEC	148	---	148	---	---	---	---
2841 SOAP	11	---	11	---	---	---	---
2876 INSECTICIDES, DISINFECTANTS	7	---	7	---	---	---	---
2914 DISTILLATE FUEL OIL	2,436	---	---	639	---	1,797	---
2915 RESIDUAL FUEL OIL	198,577	91,732	---	70,046	---	36,799	---
3011 RUBBER AND MISC PLASTICS PROD	2	---	2	---	---	---	---
3111 LEATHER AND LEATHER PRODUCTS	1	---	1	---	---	---	---
3291 MISC NONMETALLIC MINERAL PROD	300	---	---	---	---	---	300
3314 IRON AND STEEL PRIMARY FORMS	31,283	---	23,135	---	---	1,500	1,658
3315 IRON, STEEL SHAPES, EXC SHEET	113,829	22,159	51,425	---	37,725	1,288	1,232
3317 IRON AND STEEL PIPE AND TUBE	5	---	5	---	---	---	---
3319 IRON AND STEEL PRODUCTS, NEC	2,516	---	26	---	---	---	2,490
3324 ALUMINUM AND ALLOYS, UNWORKED	19	---	19	---	---	---	---
3411 FABRICATED METAL PRODUCTS	118	---	118	---	---	---	---
3511 MACHINERY, EXCEPT ELECTRICAL	713	238	274	---	---	200	1
3611 ELECTRICAL MACH AND EQUIP	12	---	12	---	---	---	---
3711 MOTOR VEHICLES, PARTS, EQUIP	228	---	228	---	---	---	---
3731 SHIPS AND BOATS	1	---	1	---	---	---	---
3791 MISC TRANSPORTATION EQUIPMENT	11	---	11	---	---	---	---
4011 IRON AND STEEL SCRAP	7,647	---	---	---	---	5,632	2,015
4112 COMMODITIES, NEC	13	---	13	---	---	---	---

TOTAL TON-MILES, 13,945,371.

TABLE 3

general trend of development in the Winyah Bay area and desires for future development: "In summary, the majority of the developed land uses in Georgetown County have occurred in the incorporated areas of Georgetown and Andrews, and in the Waccamaw Neck area. Future development is expected to follow this same trend. Careful consideration must be given to such factors as soil, topography, environment, public facilities, and services in locating future development. The capabilities of the land have influenced past development, and will continue to do so in the future. Pressures for developable land should not endanger valuable agricultural land. Land utilized for this purpose should be protected when it is in its most suitable use. The additional land needed for development should come from that which is currently undeveloped, or not in its highest potential use." The 208 plan for the Georgetown area is not yet complete. When completed in the near future, portions of the plan may provide the basis for Federal, State or local regulations that will greatly affect the development in the Georgetown area. Similarly, a Coastal Zone Management Plan has not been adopted; however, if such a plan is adopted at a later date, its implementation would also influence development in the area.

3.01 Maintenance of the existing project would not adversely affect existing land uses or zoning. The lack of a deeper port would not, however, be in accord with wishes of the major users of the port or plans to develop the Sampit River area, as described in the "Preliminary Feasibility Study for Sampit River Channel Development" prepared for the City of Georgetown in November, 1975. Placement of dredged material is not an unavoidable adverse impact on land use and could be located such that no change in general land use or zoning is required. If material were placed on upland sites, a temporary change in land use could occur in forests or agricultural lands. Placement of dredged material in undisturbed wetlands is unlikely. However, should unusual circumstances require such disposal, a permanent loss of these areas for conservation or preservation would occur.

3.02 Deepening of the existing channel to 35 feet would not have a direct impact on land use or zoning. Any secondary development due to the deeper channel, such as new industry or supporting facilities, would likely cause a change in present use of the sites selected. The deepening alternative in the existing channel alignment would attract development in the general area of the present terminals and the area immediately south of the Sampit River. This development would be in accord with the expected trends and desires of the City of Georgetown and Waccamaw Regional Planning and Development Council. Disposal of dredged material need not cause a change in zoning or land use as explained in the previous section. This alternative would, however, require a much larger amount of dredging, and the much larger disposal area needed would be difficult to obtain adjacent to deep water.

3.03 For the same reasons stated in the two previous sections, the dredging of a channel to a site in the lower part of Winyah Bay would not have any direct effect on land use or zoning. The location of a terminal near Estherville, however, would not be compatible with zoning (present zoning is Forestry-Agriculture and Conservation-Preservation) and present land use. The additional storage yards, support facilities, railroad and secondary development which could develop in the area would also not be in agreement with zoning or local plans for this area. See related information in Sections 2.0 and 4.0, and Plates 11-13.

4.0 The Probable Impact of the Proposed Action on the Environment.

4.01 General. This section, like Section 2.0, is divided into subsections which discuss impacts common to all plans, and subsections which describe impacts which are specific to individual plans. For those impacts which are common to all plans, the extent and severity of impacts can be gauged for an individual plan by consulting Section 1.08 for the amount of dredging required and by consulting Section 2.0 and the appropriate figures for a description of the affected area. This avoids repetition, but allows each plan to be considered separately.

4.02 Impacts common to all plans. A major impact of channel deepening and maintenance is related to the effects on water quality and on the ecosystems within the harbor and disposal areas. Water quality is affected mainly by local periodic increases in turbidity and sedimentation of adjacent water areas because of the bottom disturbance by the dredge cutterhead and the suspended and dissolved material in the effluent from the disposal areas. The effects on disposal areas include the smothering or displacement of plants and animal communities and in an upland area, the prevention of any substantial regrowth or colonization as long as the area continues to be used as a disposal area.

4.02.1 Open water. It is characteristic of any hydraulic dredging project that water turbidity in the vicinity of the dredge will increase as a result of the mechanical action of the dredge cutterhead. Observations of maintenance dredging in the harbor indicate there will be a temporary increase in turbidity in the area of dredging and although visible at the surface only in the immediate vicinity of the cutterhead, the plume may extend several hundred feet upstream or downstream as determined by tidal currents. Some increase in turbidity can also be expected adjacent to the upland disposal areas, although the use of dikes and weirs greatly reduces the sediment content of the disposal area effluent. The water turbidity in the offshore disposal area will also increase during and for a short time after the disposal of dredged

material. The temporary and localized effects on resident biota of increased water turbidity are not considered to be of a magnitude to affect long-term productivity.

4.02.1.1 In addition to increased turbidities, the disturbance of bottom sediments by the dredge may resuspend chemical substances, possibly increase levels of nutrients, toxic substances and B.O.D. Such effects would be most noticeable in the immediate vicinity of the dredge. As indicated in Section 2.02.4, levels of pollutants in sediments sampled in April 1977 were relatively low, and there is little or no relationship between the bulk content of the metals in sediment and their release into the water column during dredging and disposal. Based on analyses of sediments, elutriates, water in Winyah Bay and the meats of filter feeders, and on the concentrations listed in EPA's publication 440/9-76-023, "Quality Criteria for Water," no significant adverse impact on water quality, fish or wildlife should occur as a result of the proposed dredging operations.

4.02.1.2 Phytoplankton. From research conducted in areas similar to Georgetown Harbor, it appears that the effect of dredging on the primary production of phytoplankton is initially inhibitory due to increased turbidity. Recovery, of phytoplankton population however, takes place downstream.

4.02.1.3 Zooplankton. Research conducted on the survival of zooplankton (Reference 5) indicates that water which comes from the disposal site is more toxic than the water at the dredge site or downstream. It appears that zooplankton populations may be reduced during actual dredging operations, but the area affected is comparatively small and effects decrease rapidly with distance from the dredging operation.

4.02.1.4 Invertebrates. In most dredging projects, one of the most significant periodic impacts in the channel area is the physical destruction of benthic invertebrates by the dredge cutterhead. This gross effect has been well documented in many studies and field investigations conducted along both the Atlantic and Gulf Coasts and can be expected to some extent during maintenance of Georgetown Harbor. In addition, some smothering of benthic organisms may occur in areas immediately adjacent to the channel as stirred up sediments settle to the bottom.

4.02.1.4.1 The greatest concentrations of benthic invertebrates in the Georgetown Harbor estuary occur in the shallower portions in and around the salt marshes, and not in the deeper channelized areas. For the two plans following the existing alignment (Plans A and B), the area of greatest impact will be in the immediate vicinity of the dredge. The overall long-term impact on benthic invertebrates would be insignificant for these two plans as repopulation of disturbed areas by recruitment from adjacent areas would begin shortly after dredging is completed. Plan C requires dredging of a new channel and initial disturbance of the

new alignment as well as maintenance of the new but shorter channel.

4.02.1.4.2 Many benthic organisms inhabiting the offshore disposal area would probably be smothered as materials dredged from the entrance channel are deposited. This again would be a periodic disturbance as organisms destroyed would be replaced by recruitment from surrounding areas. It should be noted that EPA approved ocean disposal sites are chosen to avoid areas of high productivity. Also, the effects of offshore disposal are not always deleterious. In some cases the introduction of nutrient-rich materials to barren, sandy bottoms has improved the habitat for benthic invertebrates.

4.02.1.5 Fish and commercial and sport fisheries. The Georgetown Harbor estuarine system supports a diverse array of fishes. Although many of these species are occasionally found in deeper portions of the estuary, the majority are usually associated with salt marshes and shallower water areas which will not be significantly affected by the proposed project.

4.02.1.5.1 Available data indicate that fish populations, unlike benthic invertebrates which are relatively immobile and may undergo population reductions that may be locally severe, are less likely to be adversely affected by dredging operations. In some areas, dredging could even be considered to be beneficial to certain species of fish. As a dredge works its way along a channel, benthic animals which would normally be buried in the sediments are dislodged and become susceptible to predation. This sudden availability of food quite often results in higher than normal concentrations of fishes near the dredge. Ocean disposal could create a similar situation.

4.02.1.5.2 Althoug. it would appear that fish are relatively unaffected by dredging, there has been come concern in the last few years over the possible effects of increased turbidities and siltation associated with dredging. As a dredge moves along the channel, it invariably creates some type of turbidity plume, the size of which will vary considerably depending on the type of sediment being dredged, strength of currents and other factors. The magnitude of the impact of suspended particles on fishes will, in most cases, be dependent on the concentration, composition, absorbed minerals, or toxins and the tolerance of particular species. In general, bottom-dwelling species are the most tolerant of suspended solids, filter feeders are most sensitive and juvenile forms are more sensitive than adults.

4.02.1.5.3 Under experiment conditions, fish subjected to extremely high concentrations of suspended soils have died from suffocation due to clogging of the gills and opercular cavities. However, under normal circumstances, fish avoid turbid waters and have the ability to clear gill membranes of accumulated silt upon entering undisturbed water. However, not all species are equally susceptible to suspended solids and

different suspended solids vary in their effect. As a general rule, it has been found that fish can tolerate high turbidities except when they are accompanied by low levels of dissolved oxygen, acids, alkalies, or other substances which interfere with respiration, injure gills or prevent their normal function, and they are quite capable of leaving the immediate dredging area.

4.02.1.5.4 Turbidity plumes created by the proposed project would primarily be restricted to the channel area with some adjacent shading, depending on wind and tidal velocities. Fish species which would have the highest probability of being affected are the filter feeders (primarily menhaden, herring, and shad) and juvenile forms. Estimates of the relative abundance of these species in the channel area at any given time varies so that it is not practical to attempt a quantitative determination of the impac' on these species. In addition, some larval fishes would be destroyed either as a result of the mechanical action of the dredge, being exposed to turbid water, or being exposed to toxic substances in sediments. However, based on research which has been accomplished in other areas and available information on the effects of current dredging practices in the harbor, it is felt that any impact resulting from the proposed maintenance would be of a periodic, localized nature and would not significantly affect the fish stocks in the Georgetown estuarine system.

4.02.1.5.5 Principal commercial species marketed in Georgetown are shrimp, blue crabs, oysters, clams, alewives, American eels, flounder, whiting, black sea bass, and spot. A majority of these species are captured in offshore fisheries which would not be directly affected by maintenance dredging. Oysters and clams are found in shallower areas of the harbor and will not be affected by Plans A and B. Plan C could disturb or destroy some shellfish, although the affected areas are closed due to coliform count. The clams and oysters marketed in Georgetown come from other areas along the coast. Shrimp and blue crabs are found throughout the estuary and there is a definite possibility that some will be killed if they come in contact with the dredge cutterhead. Although numbers destroyed could be quite large, the impact will be temporary and will not significantly affect recruitment to the offshore fishery. Many of the commercial and sport fish species spend a portion of their life cycle in the estuary and could be adversely affected by turbidities or could be picked up and destroyed by the cutterhead. The impact on the population of these fish is expected to be temporary and insignificant.

4.02.2 Ocean disposal site. The impact of offshore disposal is difficult to quantify, however, it appears that this method for disposal has few adverse effects if the dredged material does not contain highly toxic substances. The material from the entrance channel is predominately sandy and is exempt from detailed analyses or restrictions.

The disposal site is an EPA approved interim site. Chemical and bioassay tests in accordance with EPA Ocean Dumping regulations would be performed prior to dumping to determine the suitability of the material for ocean dumping. In some cases, disposal may be beneficial. The accumulation of mud deposits in adjacent areas could create habitat for valuable species such as Penaeid shrimp. This in turn, could generate potential for increases or, at least, more productive commercial fisheries.

4.02.2.1 Porpoises, turtles, and birds rely on the open water area only for feeding and resting. Since the proposed dredging is not expected to significantly affect invertebrate and fish population, it should also not affect the value of the open water area as habitat for these animals.

4.02.3 Beach and dune. Within the Georgetown Harbor area, the beach and dune community is a narrow zone bordered on one side by water and on the other by marsh. Because of the high value now placed on estuarine marshes, it is considered unlikely that new disposal areas in the marsh zone will be acquired when existing areas are depleted. If one of the deepening alternatives were implemented, beach nourishment might be used in cases where the dredged material is of sufficiently large particle size, free from pollution and within reasonable pumping distance of a beach that would benefit from nourishment. Organisms inhabiting this beach zone will be covered as material is pumped onto the beach. When considered in terms of numbers of organisms which may be potentially destroyed, the periodic adverse impact will be significant. Because animals from high energy beaches are motile and adapted to shifting sediments, rapid recovery of the fauna on these beach areas following the deposition of dredged materials is likely. This is particularly true if the dredged material is similar to that of the original beach in grain size and other characteristics (Thompson, 1973). The long-term impact on invertebrates in the beach community is therefore expected to be insignificant.

4.02.4 Marsh. Because of the high premium now placed on estuarine marshes, it is considered unlikely that new disposal areas in the marsh zone will be acquired when existing areas are depleted.

4.02.4.1 Marshes previously diked and currently used as disposal areas become progressively altered until the ground elevation exceeds the height reached by spring tides. When the ground surface is no longer subject to tidal overflow as a result of the deposition of dredged material, the disposal area begins to take on the characteristics of an upland area. Plants such as smooth cordgrass, black needle rush, salt reed-grass, cattail, wild rice, and bulrush are eventually replaced by other grasses, poke berry, silverling, and wax myrtle. This conversion to an upland environment represents a permanent loss of the marsh involved in the disposal operation.

4.02.4.2 The loss of marsh also represents a reduction in the habitat available to marine forms. Some species of fish such as the

AD-A149 466 DEEPENING AND EXTENDING CHANNELS FOR NAVIGATION GEORGETOWN HARBOR SOUTH CAROLINA REVIEW OF REPORTS(U) CORPS OF ENGINEERS CHARLESTON SC CHARLESTON DISTRICT 2/2

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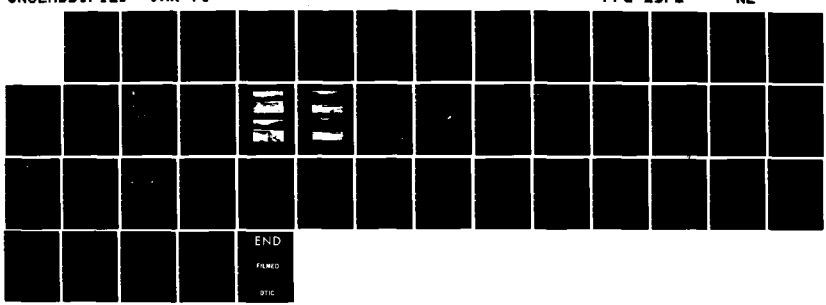
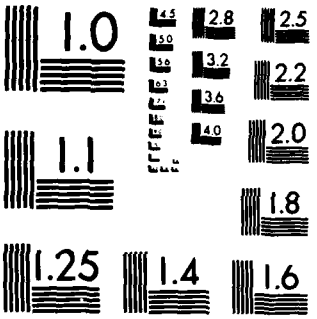




MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

speckled trout spend their entire lives in estuaries. Others, including white and brown shrimp, blue crabs, croakers, spot, and red drum spend part of their juvenile life in marshes and adjacent water areas. Consequently, the functional importance of marsh extends beyond its intrinsic potential biological productivity. While it is recognized that these marshes play an important role as a nursery area in the life cycle of many species, this role has not been quantified to the extent that its effect can be described on a per acre basis. However, any further diking of marsh for the disposal of dredged material would represent an additional loss of important habitat for these species.

4.02.4.2 Shorebirds, waterfowl, gulls, herons, plovers, dowitchers, sandpipers, clapper rails, red-winged blackbirds, grackles, sparrows, and marsh hawks will be displaced to a large extent from marshes during their conversion to an upland environment. Mammals such as the raccoon, opossum, marsh rabbit, and various rodents will continue to use disposal areas although its habitat value may be reduced. After shrubs and small treees become established, small birds such as sparrows, red-winged blackbirds, grackles, small rodents and marsh hawks will return. Occasional uses of disposal areas include the establishment by herons, egrets, and ibises of rookeries such as those on each end of Drum Island in Charleston Harbor. Other ground nesting birds such as certain species of tern, black skimmers, and gulls nest on islands created by open water disposal operations.

4.02.5 Woodlands. Woodlands now appear to be one of the two most likely areas to be selected for disposal of dredged material when the currently used disposal areas are used to capacity. Woodlands are one of the largest environmental types in the Georgetown Harbor area, and the rationale for preservation of individual tracts of marsh does not apply to these woodlands. Woodlands are also less expensive than urbanized areas and would, therefore, be more suitable from the project sponsor's viewpoint.

4.02.5.1 Prior to the use of any wooded tract of land, the owner would probably remove merchantable timber. In any event, dense stands would be removed to permit a more even distribution throughout the disposal area of the hydraulically dredged material. Any trees not removed and all understory plants would be killed when their roots become covered to a sufficient depth. Vegetation regrowth would consist probably of poke berry and other herbs and shrubs such as silverling and wax myrtle, and trees of most of the same species growing prior to dredging.

4.02.5.2 Practically all significant animal life except for some small birds would be displaced during and shortly after the use of a wooded disposal area. Raccoons, opossum, and some small rodents might continue to forage without interruption in the disposal area. As vegetative regrowth begins, foraging by the other species that were displaced during the preparation and clearing and subsequent use of the area will increase. Plant and animal life will fluctuate from a low

during and shortly after deposition of dredged material to a high just before a dredging operation. When capacity has been reached, a reversion to a wooded state by sweetgum, pines, hackberry, oaks and other upland species will occur unless man's activities intervene through use of the area for cultivation or residential or other development. Material dredged from Winyah Bay is well suited for farming.

4.02.6 Agricultural land. Agricultural lands, along with woodlands, appear to be one of the most likely areas to be selected for the disposal of dredged material when the currently used disposal areas are used to capacity. Agricultural lands are one of the small categories of land use but some of the basic restrictions operating against the selection of marsh and urbanized areas referred to earlier do not apply.

4.02.6.1 The impact on wildlife of using cultivated land for the disposal of dredged material depends on the length of time since the land was last cultivated. Recently cultivated land usually has very little utility for wildlife because of the common practice of clean farming, and the use of such an area for disposal would have little impact on wildlife. Fields that are left fallow for some time provide habitat for a number of small animals. Most of these would be displaced by dredged materials. Vegetative regrowth would begin shortly after the area dries with pioneer species such as poke berry, and other herbs and grasses being the first to appear. Shrubs such as silverling and wax myrtle and trees such as sweetgum and sassafras would appear shortly afterwards. As vegetative regrowth progresses, foraging by animals displaced during dredging will increase. The extent of this foraging will also depend on the quality of adjacent habitat. If such a disposal area were bordered by woods, a greater diversity of animal life might forage in the disposal area than if it were bordered by cultivated fields. Plant and animal life will fluctuate from a low during and shortly after deposition of dredged material to a high just before a dredging operation. When capacity has been reached, a reversion to a wooded state by sweetgum, pines, hackberry, oaks, and other upland species will occur unless cultivation is resumed or the area is placed into residential or other development. The dredged material is very well suited for farming and has been so used on Cat Island and South Island and this land could be used as productive farm land once capacity has been reached.

4.02.7 Urbanized land. The use or urbanized areas for disposal sites does not appear practical because such a use would be incompatible with human use of adjacent areas. The cost of urbanized property also would deter its use for this purpose.

4.02.8 Endangered species and threatened species. Several of the species listed in Section 2.06.7 are known to be present, at various times, in the harbor area. To the extent that upland disposal sites are used in lieu of marshlands, those birds using uplands near rivers and coastal bays could experience some loss of habitat. The cooperative interagency efforts described in Section 1.09.5 should prevent excessive loss of this habitat where crucial to endangered species.

4.02.9 Mosquitoes. The use of diked disposal areas to avoid adverse effects on estuarine values has an adverse effect in that diking in the coastal zone creates ideal habitat for the salt marsh mosquito. Because of the present impracticality of natural control techniques in these disposal areas, mosquito control requires frequent inspection and spraying. The most commonly used insecticide is Flit M.L.O. which dissipates quickly and has little adverse side effects, but the necessity of frequent treatment of disposal areas is expensive. The Federal responsibility in this project does not include mosquito control, which is the responsibility of the State Ports Authority of South Carolina as the sponsor of the Georgetown Harbor Navigation Project.

4.03 Impacts specific to each plan. The following impacts are primarily associated with actions other than the actual dredging and disposal of dredged material.

4.03.1 General nature of secondary development likely to occur as a result of the channel alternative.

4.03.1.1 Plan A. The maintenance of the existing project could attract industrial or commercial enterprises which are capable of using a 27-foot channel. This continued maintenance represents no change from existing harbor features, and growth, if any, would likely occur near the present terminals and other locations in the City of Georgetown. No transportation facilities would be required in addition to those already planned to handle expected growth in the Georgetown area. No changes would be required in present land use or zoning as a result of Plan A (see Section 3.0).

4.03.1.2 Plan B. Deepening the channel to 35 feet along the existing alignment would likely attract additional industries to the area which could make use of the deeper channel. This alternative would provide the depth and alignment necessary to implement plans by the City of Georgetown to construct a connecting channel, extensive docking and industrial sites south of the Sampit River. Railroad service is available and a large powerplant is located about six miles to the south. Growth which might occur would be located south of and adjacent to the Sampit River, as well as in the areas near existing terminals. These existing terminals would then be able to unload cargo which can not be shipped through the existing 27-foot channel. Development of the area south of the Sampit River would change the present land use (dredge disposal area and pine forest) but would not require any change in

zoning. The area is already zoned for heavy industry and light industry.

4.03.1.3 Plan C. The construction of a 35-foot channel terminating at a turning basin adjacent to Estherville Plantation would require the relocation of terminals to this area by the State Ports Authority and private companies. Further change would occur due to a possible railroad, storage area, support facilities, and other secondary development of a commercial or residential nature. Present land use is forestry, light and scattered housing, some agriculture and undeveloped wetlands (see Figure 12). The changes described above would not be compatible with present zoning (Forestry-Agriculture and Conservation-Preservation).

4.03.2 Noise.

4.03.2.1 Plan A. No increase in existing noise levels is anticipated due to this alternative.

4.03.2.2 Plan B. Blasting of rock would probably be necessary to deepen the channel above Station 800+00, and certain locations below Station 800+00. Removal of 16 vertical feet of rock would be necessary in most of these areas in order to maintain the channel at 35 feet. The blasting would be audible to residents of the area and wildlife in the harbor and adjacent areas. After construction of the deeper channel, noise levels would be similar to levels without the project, except in the areas which might attract new industries. In addition to the disturbance due to blasting noise, some destruction of fish and invertebrates would occur in the immediate vicinity of the blasting as a direct result of the blasting itself.

4.03.2.3 Plan C. Noise levels would increase in the area of the new terminal site and in areas of secondary development. The levels would be similar to those at the present terminal, but would be a proportionately large increase over the existing ambient levels in the rural, undeveloped area around Estherville.

4.03.3 Air Quality.

4.03.3.1 With the exception of particulates, pollutants in the Georgetown area do not exceed ambient air quality standard levels. Particulate levels have exceeded short-term and annual geometric mean primary standards. The problem is a combination of fugitive dust around industrial sites, work and storage areas, re-entrained road dust, other area sources and point source discharges. Georgetown is developing an Air Quality Maintenance Plan which must assure that all discharges in the future will not violate standards for particulates.

4.03.3.2 Some increase in industrial development and subsequent growth could reasonably be expected over a long period if a 35-foot channel were constructed (Plans B and C). The type of growth which

might occur, the amount and types of pollutant discharge into the atmosphere, the location of these discharge points and when the growth might occur can not be forecast. Most new industries would be required to meet New Source Performance Standards and would not be allowed to violate State or Federal air quality standards. Certain types of industries would also be subject to Significant Deterioration regulations, Hazardous Materials regulations, and Air Quality Maintenance Plan for Georgetown. The increase in ambient air quality levels due to a terminal and secondary development would, like noise, be proportionately greater for the Estherville area because of its present rural, undeveloped nature.

4.03.4 Discharge into surface waters as a result of anticipated secondary development.

4.03.4.1 General. New discharges from point sources would be regulated and permitted by the S. C. Department of Health and Environmental Control. A plan in accordance with Section 208 of P.L. 92-500 is being developed to identify and quantify the existing discharges from point and area sources in the Georgetown area, and to anticipate and regulate future discharges. Information from this study which could be used to gauge the relative impacts of anticipated growth due to a particular channel alternative is not now available. The study results should be available in time for use in the event that a project is authorized.

4.03.4.2 Plan A. The likelihood of a small increase of development due to this alternative was discussed in previous sections. No significant increase in point source discharges or surface runoff is anticipated as a result of this alternative.

4.03.4.3 Plan B. Because this plan is likely to attract some new industry and other development, an increase in both point source discharges and surface runoff is anticipated. As with noise and air pollution, the size of the increase would depend on the amount of development, the type of development, where the growth occurs, and the degree of regulation by permits and land use. As previously stated, most growth due to this alternative would occur near the existing terminals or immediately south of the Sampit River. This area is already subject to relatively large quantities of pollutants in surface runoff. With a deeper channel, larger vessels and more cargo would pass through Winyah Bay. The likelihood of spills occurring in the harbor or at transfer points would also be increased, as would bilge discharge. A shipping accident involving the rupture of a large vessel would have more potential for severe impacts. With the exception of fuel oil, most of the cargo now being shipped through Georgetown would not degrade water quality if spilled into the harbor (see Table 3). The nature of materials shipped by future industries locating in the harbor can not be forecast.

4.03.4.4 Plan C. As with the other deepening alternatives discussed above, some unknown quantity of discharge into surface waters is likely to occur due to new terminal facilities, new industry and related development. Plan C. differs from Plan B in that a western channel to Estherville would require the relocation of terminal facilities to the lower harbor. This new construction, and any nearby development, would result in discharge into waters and adjacent marsh which now receives little pollution of this type from these lands. Some of the secondary growth which might occur due to this laternative would be in the City of Georgetown, such as housing, expansion of existing industrial plants, or new industry which might only use the terminal, to transfer cargo to Georgetown. See appropriate portion of Sections 1.0 and 2.0 concerning the type of vegetation, wildlife, and other features which might be adversely affected by such discharge. The possibility of spills, bilge discharge and rupture with Plan C is similar to that described for Plan B above.

4.03.5 Ground water. Neither of the deeper channels would breach a major water supply aquifer. The primary ground water source in this area (500 to 700 feet deep) is the Black Creek formation in which the static water level is approximately 73 feet. This aquifer due to overlying clayey aquitards should not be affected by channel deepening. However, limestone and sand units within formations overlying the deep Black Creek aquifer, e.g. Santee Limestone, Warley Hill and Black Mingo, are privately utilized and represent potential shallow water supplies. Even if portions of these units were cut by a deeper channel, the high freshwater recharge could lessen any impact. Shallow test wells or existing wells would have to be sampled to determine local shallow water characteristics.

4.03.6 Archeological and historical sites.

4.03.6.1 Continued dredging in the existing alignment (Plans A and B) would have no impact or archeological or historical resources. Since the completion of the harbor channel in 1949, maintenance dredging has been accomplished annually, and it is highly unlikely that continued maintenance would disturb anything of cultural value. Existing disposal areas will be used until filled to capacity. When new sites are required, those which might contain cultural resources will be surveyed. The National Register of Historic Places has been consulted and no register properties will be affected by any of the alternatives. A brief from the Department of the Interior states that Bellefield Plantation has been determined to be eligible for the National Register of Natural Landmarks. Bellefield is located on the Waccamaw Neck and is controlled by the Belle W. Baruch Research Foundation. Disposal site "A", which is currently being used, lies within former marsh on this property. Discouragement by the Corps of the use of marsh for future disposal sites and the interagency selection process should prevent the State as local sponsor from choosing additional sites in this area.

4.03.6.2 The construction of a channel to Estherville Plantation and its maintenance would not have a direct adverse impact on the historical value of the property; however, the location of a terminal on

this site and other development in the area could affect the character of the site by alteration of the property itself, alteration of its surrounding environment and the introduction of visual, audible and atmospheric elements. Not all portions of the property merit equal consideration, e.g., the house is a 20th century structure, and portions of the former rice fields have been used in the past for disposal of dredged material. A determination of which segments are historically important should be made by the State Historic Preservation Officer in his evaluation of Estherville's nomination to the National Register. Also, the value of this plantation relative to similar properties should be established by this evaluation. The general nature of anticipated development would be out of character with the setting of the area if it is determined to merit protection as a result of its location, building and structures associated with early rice cultivation. The area at the junction of the AIWW with Winyah Bay which was used for deposition of material from the construction of the AIWW would be the likely choice for locating a terminal. Sufficient acreage exists on this altered land for the unloading facility itself. Supporting facilities and secondary growth might locate on adjacent land. As was stated in previous sections, the extent, exact location and specific type of secondary growth can not be forecast.

4.03.7 Economics.

4.03.7.1 The continued maintenance of a 27-foot channel to Georgetown (Plan A) would continue to have a favorable economic impact on the area. Ships serving the area now would help and possibly expand the industrial base now being established in Georgetown. This would directly and indirectly have a beneficial effect on the local, state, and national economy.

4.03.7.2 The deepening of the channel to 35 feet along the full length of the existing alignment (Plan B) would generate a substantial increase in benefits to present users based on current shipment levels as shown in Table 3 and the anticipated expansion by present users; however, annual charges far exceed these benefits. It is possible that new benefits would be generated by new industry attracted to the area, thereby increasing total cargo shipments. The Corps can not, however, include such benefits in a benefit/cost analysis unless some guarantee is made that the projected increase in new users and benefits will materialize. No such guarantee can now be made for benefits due to a possible increase in industry (see Table 4).

4.03.7.3 Similarly, benefits for the channel to Estherville (Plan C) were calculated based on the savings to be realized by present users. No benefits are claimed for any possible new users. In addition to benefits to shippers, further benefits would be achieved due to a savings in annual maintenance costs over present levels. The dredging costs included as part of the total annual charges are only costs of new construction and costs of maintaining the additional depth. As with

Table 4

Summary of Cost of
Plans Consideed in Detail

	ITEM	TOTAL WATERWAY	WESTERN CHANNEL TERMINAL	NORTH ISLAND TERMINAL	MARSH ISLAND TERMINAL
32 Foot Project	DREDGING				
	NEW WORK (C.Y.)	13,695,000	11,196,000	4,920,000	7,025,000
	MAINTENANCE (C.Y.)	2,955,000	914,000	75,000	420,000
	TOTAL INVESTMENT	$50,560,000	$14,960,000	$8,710,000	$11,370,000
	TOTAL BENEFITS	$ 2,254,000	$ 1,534,000	$ 0	$ 0
	ANNUAL CHARGE	$ 6,860,000	$ 3,140,000	$ 700,000	$ 960,000
	BENEFIT COST RATIO	.33	.49	0	0
35 Foot Project	DREDGING				
	NEW WORK (C.Y.)	22,205,000	16,348,000	8,600,000	12,100,000
	MAINTENANCE (C.Y.)	4,893,000	1,120,000	120,000	500,000
	TOTAL INVESTMENT	$79,780.000	$28,900,000	$14,720,000	$18,480,000
	TOTAL BENEFITS	$ 3,936,000	$ 2,757,000	0	$ 1,204,000
	ANNUAL CHARGE	$10,470,000	$ 3,972,000	$ 1,170,000	$ 1,690,000
	BENEFIT COST RATIO	.38	0.69	0	.71
38 Foot Project	DREDGING				
	NEW WORK (C.Y.)	30,779,000	22,181,000	12,900,000	17,800,000
	MAINTENANCE (C.Y.)	6,858,000	1,311,000	165,000	590,000
	TOTAL INVESTMENT	$105,120,000	$38,730,000	$21,690,000	$27,610,000
	TOTAL BENEFITS	$ 4,404,000	$ 225,000	$ 0	$ 1,668,000
	ANNUAL CHARGE	$ 14,240,000	$ 4,740,000	$ 1,710,000	$ 2,360,000
	BENEFIT COST RATIO	.31	0.68	0	.71

Plan B, Plan C could generate additional industry in the Georgetown area which would further expand the economic base.

5.0 Any Probable Adverse Environmental Effects Which Can Not Be Avoided

5.01 A detailed discussion of all environmental impacts expected to result from the project is contained in Section 4.0. Some of these impacts are considered unfavorable, but cannot be avoided by any practical means within the authority and scope of the proposed project.

5.02 Since any channel modification or maintenance will require dredging, the physical disruption, temporary changes in water quality and their effect on the harbor are unavoidable. These effects include increased turbidity and siltation in the vicinity of the cutterhead and disposal areas; a temporary decrease in primary productivity resulting from turbid waters reducing the euphotic zone; a possible reduction in dissolved oxygen levels as a result of the dredge disturbing organic matter undergoing anaerobic decomposition; and the destruction of benthic organisms by the cutterhead.

5.03 Until the special equipment described in Section 1.08.4 is available or new methods of disposal are shown feasible, some effects on disposal areas are unavoidable. The plan to use existing diked disposal areas to maximum capacity, to choose new upland sites by interagency coordination, and to use less disruptive disposal methods as they prove applicable will hold these effects to a minimum. The unavoidable effects include the displacement of vegetation and wildlife species inhabiting the diked upland disposal areas; frequent spraying for mosquitos on upland sites; and a loss of present land use as long as disposal continues.

5.04 The effects due to secondary growth which were described in Section 4.0 represent impacts which might reasonably be expected to occur in the area, based on growth in similar situations. This growth and resultant impact is not unavoidable, however. Strict enforcement of existing zoning, restriction of permits by agencies which regulate discharge into the waters or atmosphere, as well as policies and the provision of services by local governments could prevent or reduce the effects described.

6.0 Alternatives. In addition to the three alternatives discussed as Plans A, B, and C, possible channels were studied to sites on Marsh Island and North Island. Channel depths of 32, 35, and 38 feet were considered for each alternative. Table 4 shows the relative benefits and costs of the different depths. As discussed in Sections 2.01.1.1 and 2.01.1.2, both Marsh Island and North Island would require the acquisition of land which has been placed in trust for preservation and conservation. The State Ports Authority would have to acquire the land necessary for a terminal. Other State agencies are managing the land

under agreements that the property will not be used for commercial or industrial purposes. The difficulty in obtaining the property presents a problem as well as the questionable use of valuable wildlife habitat for industrial purposes when other sites are available. Studies indicate that any ships might have difficulty unloading at the North Island site. The Marsh Island site now has only one potential user, and the Corps could not construct a channel for a single user. Since neither of these sites has ready access to rail or roads, it is doubtful that either site could later be developed as a multiple-user port. For these reasons, these two sites have not been evaluated in the Environmental Assessment in the same detail as Plans A, B, and C.

7.0 The Relationship Between Local Short-Term Uses of Man's Environment and the Maintenance and Enhancement of Long-Term Productivity

7.01 Short-term uses are those which provide benefits or consume resources for a single instance or over an initial, short period. The deposition of dredged material in upland areas is a short-term use of land which might otherwise be used for forestry or agricultural purposes. After they are filled to capacity, the sites could revert to their previous use (see Table 1 and Plate 1-A).

7.02 A major long-term benefit of the various plans is the maintenance of Georgetown Harbor and its stimulus to the local and regional economy. The benefits calculated in Table 4 indicate only the value of the harbor or harbor improvements to transportation, and do not include the stimulus to related business or employment. The replacement of a shallow area in Winyah Bay with more productive marsh is a long-term enhancement.

7.03 Most of the adverse effects associates with dredging would be long-term in that maintenance dredging would have to be continued to provide long-term economic benefits. These impacts are periodic disturbances, however, and are not known to occur for extended lengths of time between dredgings.

7.04 Over a long term, Plan C would require less dredging and disposal of material than the existing project. A large amount of dredging would be needed for deepening the new channel, but less maintenance would be required. The location of a terminal in the vicinity of Estherville would in all probability result in a long-term change from a rural, undeveloped area to a more industrial and commercial area, as discussed in Sections 3, 4, and 8.

8.0 Any Irreversible and Irretrievable Commitments of Resources Which Would Be Involved in the Proposed Action Should It Be Implemented

8.01 Neither of the plans which would retain the current channel alignment to the area of existing terminals (Plans A and B) would

result in an irreversible reduction in the diversity or range of uses of local resources. Labor and fuel which are used in the construction or maintenance are irretrievable.

8.02 The plan to construct a 35-foot channel to Estherville Plantation would not involve irreversible or irretrievable commitments of resources other than labor and fuel. The construction of a terminal, support facilities and access by the local sponsor and local interests would, however, result in a change to the area which would not likely be reversed. The resources affected have been fully described in Sections 2.0 and 4.0 and Plates 4-11. Of primary concern is the permanent establishment of port facilities and related industry in an area now highly valued for its natural setting, wildlife habitat and potential for marine research. As stated in Section 2.06.1.4, domestic and industrial pollution from Georgetown limit recreation and commercial fishing between Sampit Channel and Frazier Point. A similar reduction in these and other uses is possible if large-scale development occurs in the lower harbor. The size of development, type of development and impact on the lower harbor would depend on the ability of local and State governments to enforce zoning and the degree of regulation by State and local agencies in granting permits for building construction, discharge into waters, air emissions, etc.

9.0 Coordination and Comment and Response

9.01 The first of three public meetings was held at Georgetown County Courthouse on 4 June 1970 for the purpose of introducing the study on modifications to Georgetown Harbor and to obtain information on public needs and desires. This meeting was attended by 42 persons representing Federal and State agencies, local municipalities, shipping agencies, and private individuals. A strong desire was expressed for a deeper channel to the Highway 17 bridge at Georgetown.

9.02 A second public meeting was held at the same location on 8 July 1976 to present the preliminary findings of the study and to obtain public views. Eighty-eight persons attended, representing various agencies as well as individuals. Findings presented at this meeting included:

(1) Deepening the channel all the way to the Highway 17 bridge could not be economically justified.

(2) Extension of the existing channel upstream of Highway 17 should be deferred until firm commitments are made by proposed users.

(3) The only feasible deepening alternative would be a 35-foot deep channel to an offloading terminal in lower Winyah Bay.

(4) If the people of Georgetown chose the deeper channel in the lower harbor, maintenance of the upper portion of the existing channel would no longer be justified, based on present users.

The local sponsor and most of the persons present stated that they were not interested in the alternative to the lower harbor.

9.03 A third public meeting was held 24 February 1977 at the Georgetown County Courthouse. Findings presented at this meeting included:

(1) Physical models of Georgetown Harbor constructed at the Waterways Experimental Station failed to provide any deepening alternative all the way to the Highway 17 bridge that could be economically and environmentally justified.

(2) The channel to Estherville Plantation in the lower harbor was the only deepening alternative that was economically feasible; however,

(3) No recommendation for modification of the existing project could be made at this time, unless support was forthcoming from the project sponsor (S. C. State Ports Authority), the project users, and the general public.

The State Ports Authority made the statement that it still hoped a deeper channel could be constructed all the way to Georgetown, and stated that it would conduct its own study to determine if justifications possibly overlooked by the Charleston District could be provided that would support the longer channel. The general concensus of the local governments, major users of the harbor, and representatives of the local labor force was that their first preference would be a deeper channel to the Highway 17 bridge at Georgetown, and their second preference would be a 35-foot deep channel to the lower harbor and continued maintenance of the existing 27-foot channel. Some of the major users stated that if both the 35-foot channel and the 27-foot channel could not be justified, they would support the 35-foot channel in the lower harbor by itself. The S. C. Department of Wildlife and Marine Resources and several individuals stated that they were either opposed to or apprehensive of a deeper channel in the lower harbor.

9.04 After the third public meeting, the S. C. State Ports Authority by letter of 26 April (received 15 May) stated that it would be willing to support the deepening project to a terminal in the lower harbor, provided that their support at this time for the lower terminal did not rule out extension of the channel to the City of Georgetown at a later date, should additional traffic warrant such an extension. No mention of the Ports Authority's independent study as proposed at the third public meeting was made concerning preliminary findings or an expected completion date.

9.05 A fourth public meeting was held at the armory in Georgetown on 24 January 1978. An estimated crowd of 400 attended, most of

whom supported a deeper channel. The following findings were presented at this meeting:

(1) The cost of the terminal would have to be included in the first cost of the project;

(2) Original estimates of shoaling were greater than have been actually dredged in recent years in the upper harbor, lowering the savings calculated by deauthorizing this upper portion of the existing channel;

(3) Because of recent changes to the method of shipping of ore by barge, savings could no longer be claimed to support twice annual maintenance of portions of the existing channel;

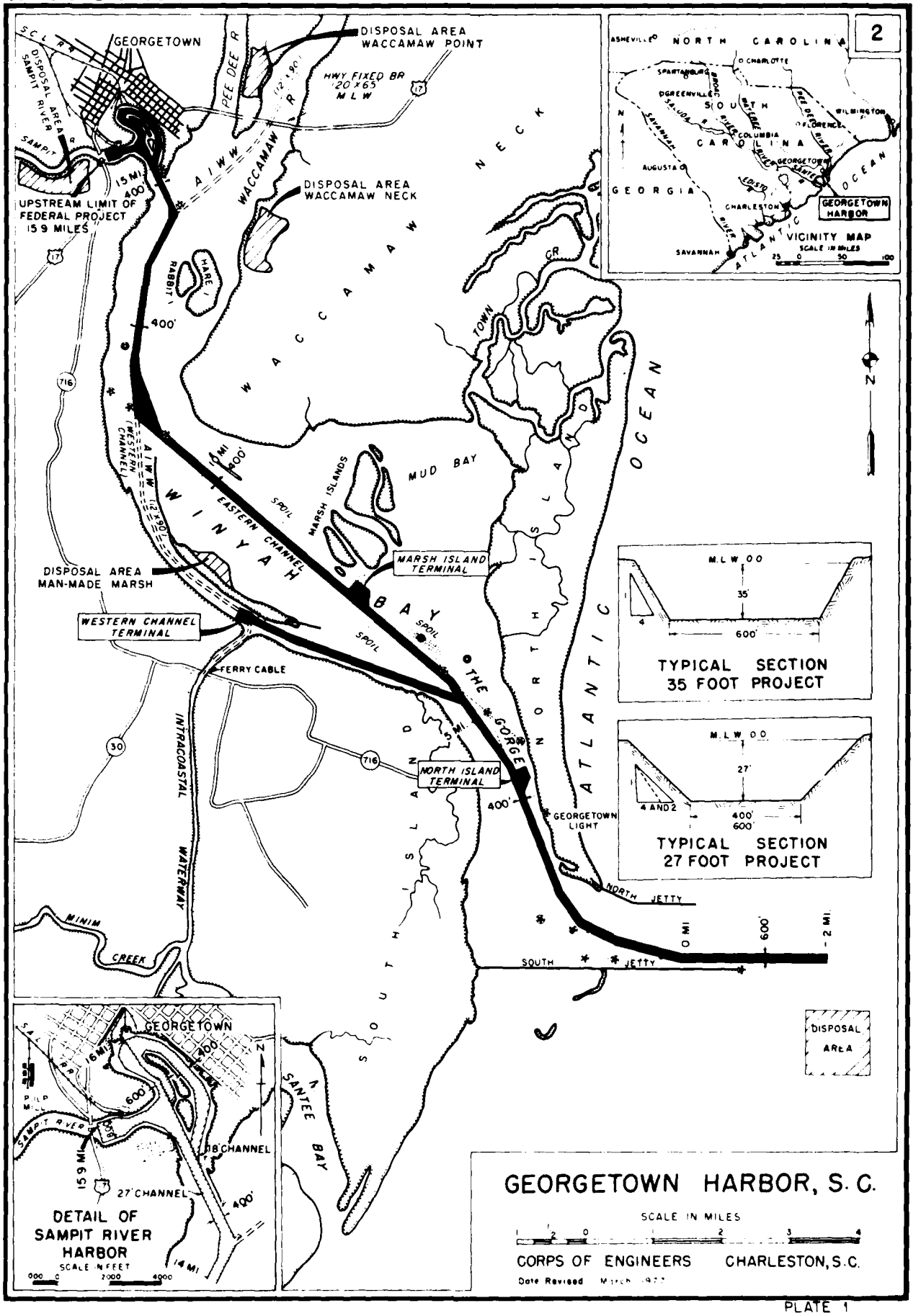
(4) Based on the presently required nationwide criteria for calculating benefits and costs, and based on present users of the port of Georgetown, no plans for deepening the channel could be recommended at this time.

Most of the State and U. S. Senators and Congressmen were present or sent representatives. Having met prior to the meeting, they uniformly supported further study of the project, criticized the narrow criteria for calculating benefits and costs, and indicated that they would be willing to effect changes in the required method of benefit/cost calculation. No specific new legislation was suggested nor was any method offered for the present study whereby benefits or costs could be calculated differently. The State Ports Authority verbally supported the project but did not present any findings of their independent study which had been proposed at the third public meeting. The major users of the port, several local officials, and many persons whose jobs or businesses would be affected by development or loss of shipping underscored the need for an active port. None of the speakers were able to present new or expanded use of the port which would permit benefits from deepening to be increased. Several persons and groups stated concern for or opposition to the 35-foot western channel, based on the environmental impact to lands which are privately owned or managed by the State of South Carolina for preservation of natural resources.

9.06 Informal coordination was conducted with the S. C. Department of Wildlife and Marine Resources, S. C. Department of Health and Environmental Control, the State Historic Preservation Office, Waccamaw Regional Planning Council, the City of Georgetown, U. S. Fish and Wildlife Service, EPA, and various groups, such as the Propellor Club and Rotary Club, and affected land owners. The City of Georgetown conducted two meetings, which were attended by Charleston District representatives, to discuss the possibility of extending the channel upstream of the Highway 17 bridge. Much of the discussion and several of the maps in this assessment were prepared using information gathered during the informal coordination.

9.07 Some of the basic information on the existing setting of Winyah Bay and the impacts due to dredging and disposal of material was circulated among the State and Federal agencies, private groups, and individuals in March 1976 as part of the Final EIS on Maintenance Dredging of Georgetown Harbor. Comments and additional information provided by this review have been considered in the evaluation of the present study. Much of this material, which has been thoroughly reviewed by the appropriate agencies, is included in the present assessment as nothing has changed in the intervening year to outdate or otherwise invalidate the portions applicable to the deepening study.

CORPS OF ENGINEERS U. S. ARMY



GEORGETOWN HARBOR, S. C.

SCALE IN MILES

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CORPS OF ENGINEERS CHARLESTON, S.C.

Date Revised March 1977

PLATE 1

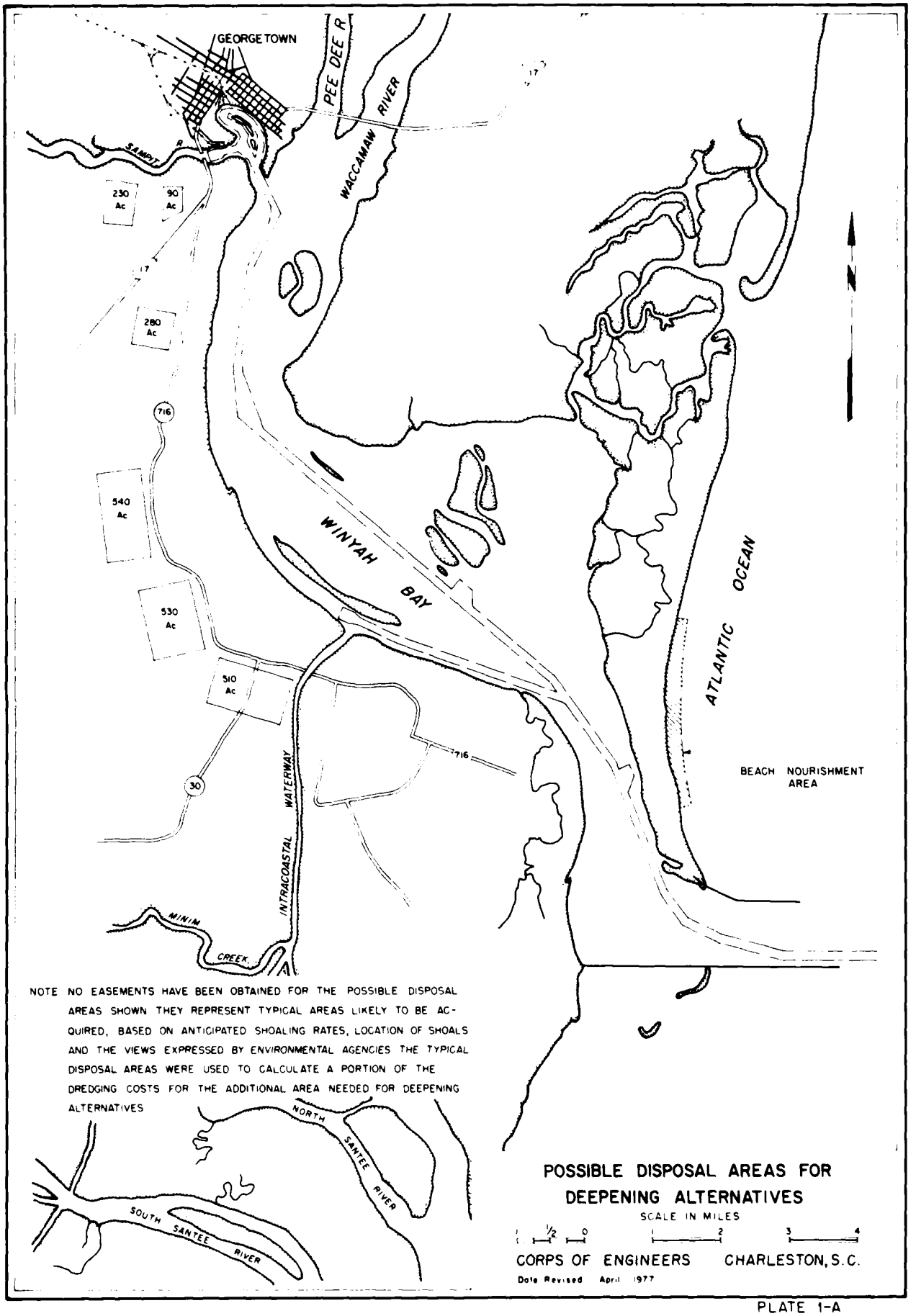

GEORGE TOWN
PEE DEE R
WACCAMAW RIVER
SAMPIT R
230 Ac
90 Ac
280 Ac
716
540 Ac
530 Ac
510 Ac
WINYAH BAY
ATLANTIC OCEAN
BEACH NOURISHMENT AREA
30
INTRACOASTAL WATERWAY
MINIM CREEK
NORTH SANTEE RIVER
SOUTH SANTEE RIVER
NOTE NO EASEMENTS HAVE BEEN OBTAINED FOR THE POSSIBLE DISPOSAL AREAS SHOWN THEY REPRESENT TYPICAL AREAS LIKELY TO BE ACQUIRED, BASED ON ANTICIPATED SHOALING RATES, LOCATION OF SHOALS AND THE VIEWS EXPRESSED BY ENVIRONMENTAL AGENCIES THE TYPICAL DISPOSAL AREAS WERE USED TO CALCULATE A PORTION OF THE DREDGING COSTS FOR THE ADDITIONAL AREA NEEDED FOR DEEPENING ALTERNATIVES
POSSIBLE DISPOSAL AREAS FOR DEEPENING ALTERNATIVES
SCALE IN MILES
½ 0 2 3 4
CORPS OF ENGINEERS CHARLESTON, S.C.
Date Revised April 1977

PLATE 1-A

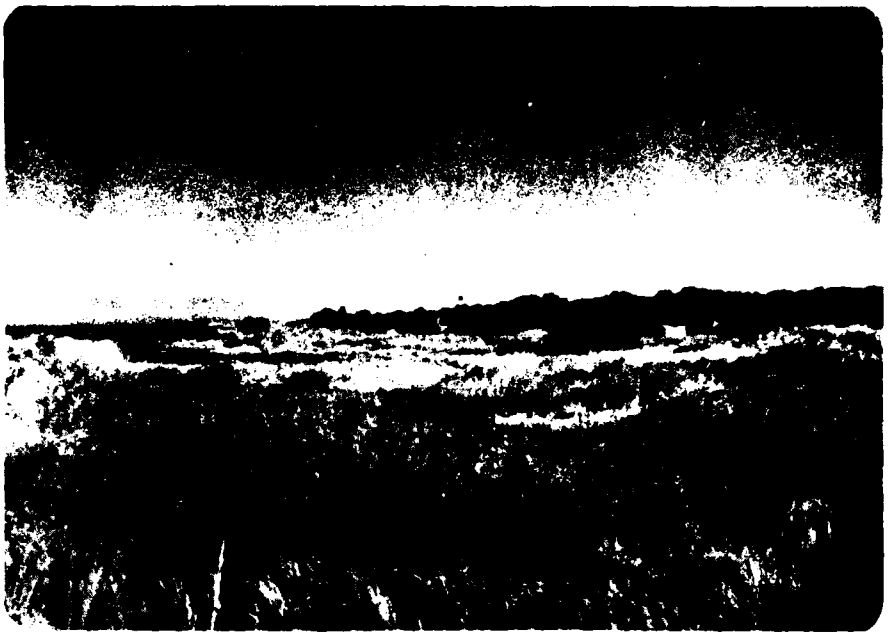
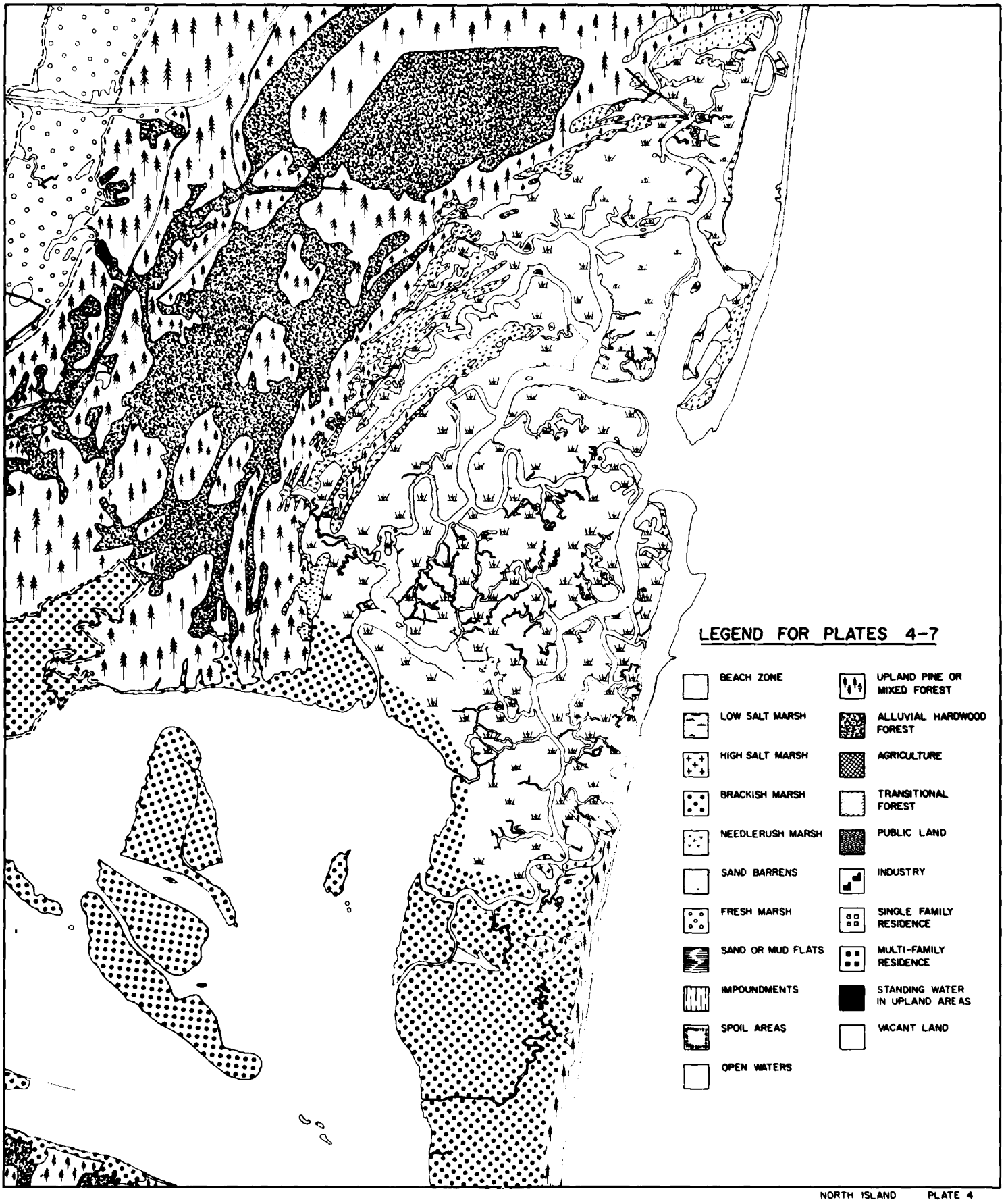


Plate 2A. North Island beach and dune community in foreground, oak-pine forest in background, and water-vapor-smoke cloud from a Georgetown paper mill on distant horizon.

Plate 2B. Low marsh, left, formed after rock jetty was constructed at the mouth of Winyah Bay, right. Oak-pine forest is seen in background on South Island.

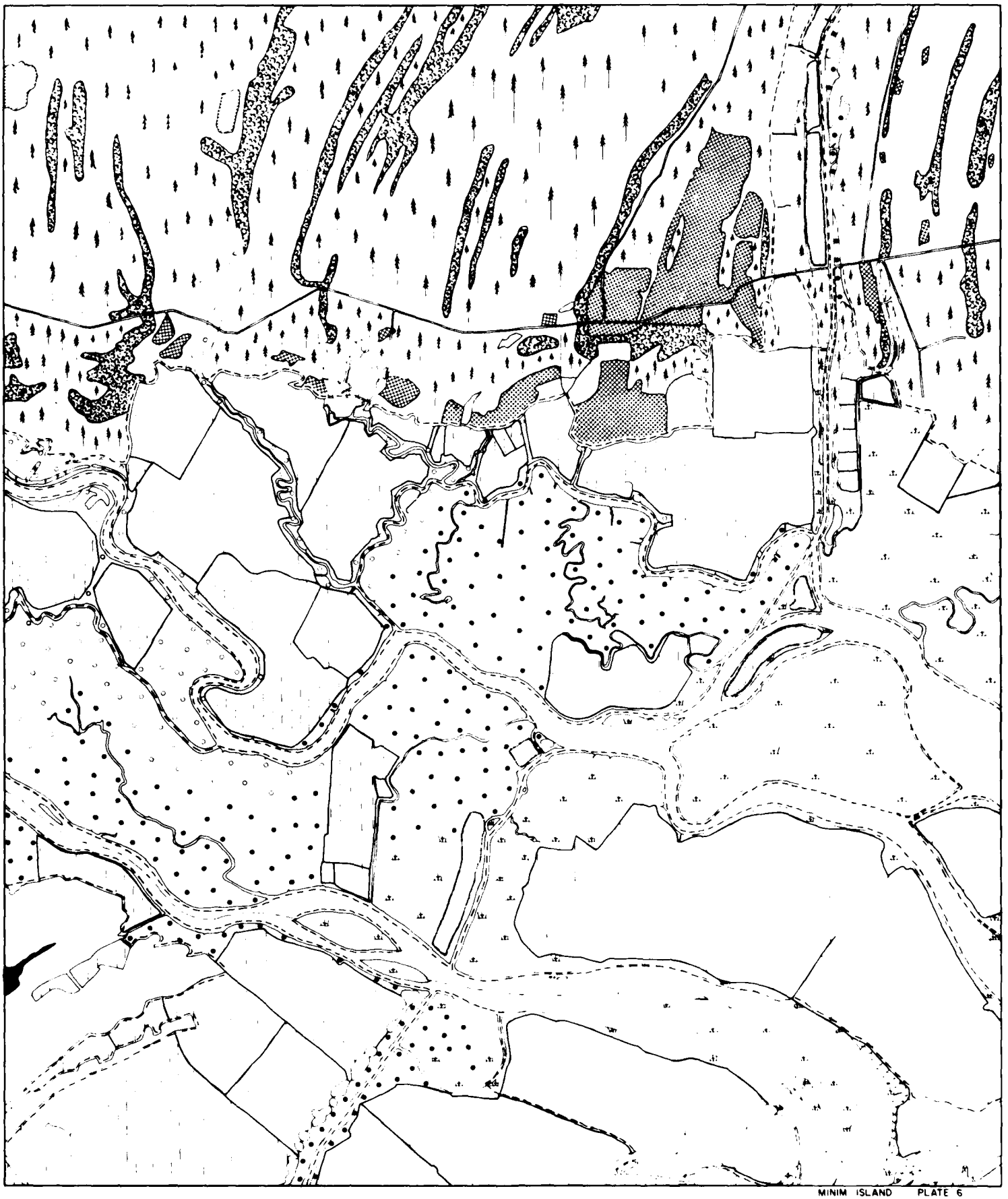
Plate 3A. High marsh, foreground, low marsh, center, and oak-pine forest in distant background. The view is toward the west of Cat Island.

Plate 3B. Difficulty with community delineation is shown in this view of Cat Island marsh - Salt flat, foreground; high marsh, right center, and low marsh left center blend into one community.

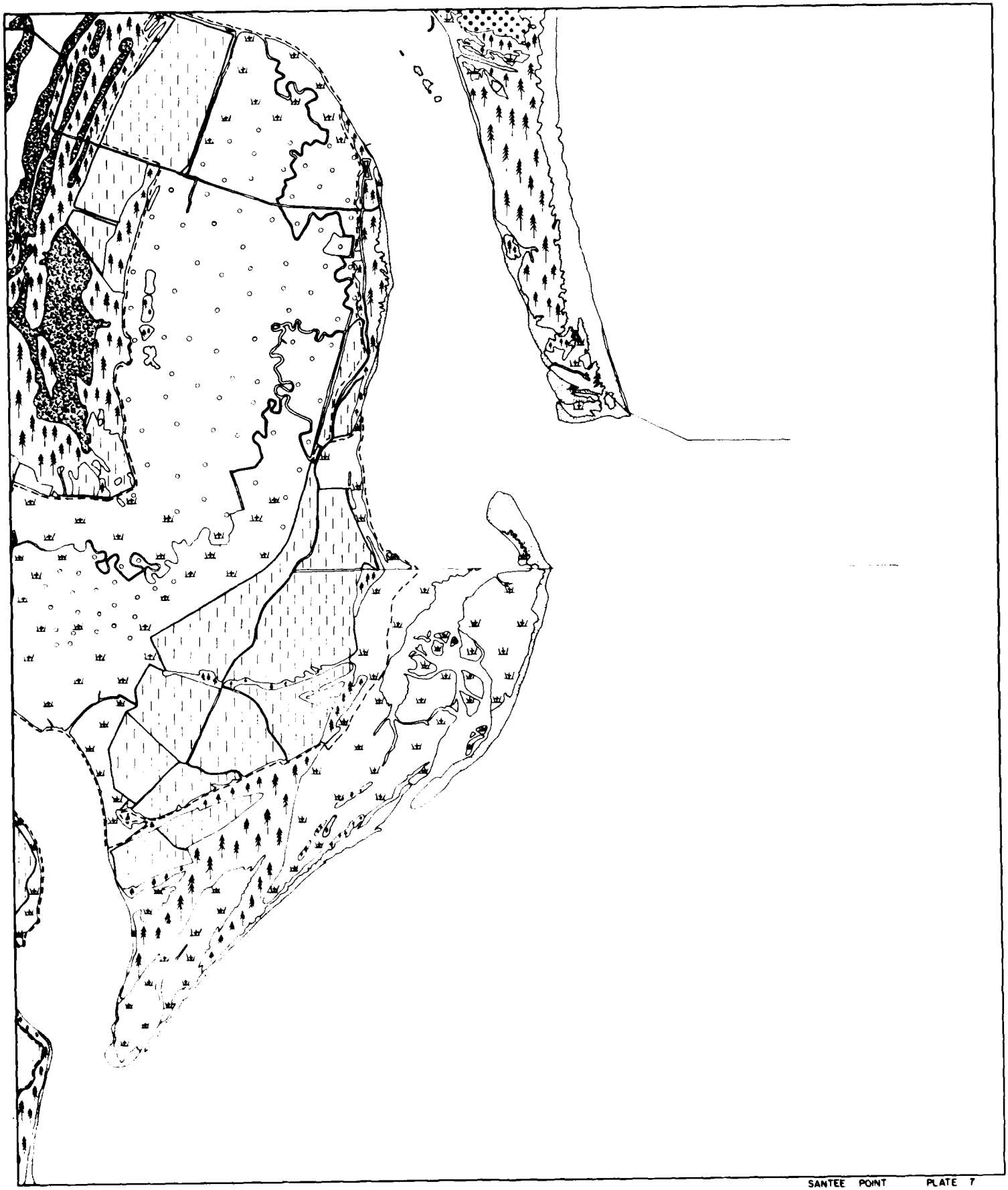


NORTH ISLAND PLATE 4

GEORGETOWN, SOUTH PLATE 5



MINIM ISLAND PLATE 6



SANTEE POINT PLATE 7

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2. Anonymous. Threatened Wildlife of the United States, USDI, Bur. Sport Fisheries and Wildlife, Commission of Rare and Endangered Species, Res. Pub. No. 114, 1973.

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5. Belle W. Baruch Coastal Research Institute, 1973. Bioassay studies, Charleston Harbor, South Carolina, the effects of dredging harbor sediments on plankton. Final report submitted to the United States Army Corps of Engineers, Charleston District. University of South Carolina, Columbia. Contract No. DACW 60-71-C-0009, April, 1973.

APPENDIX A

SEDIMENT ANALYSIS

- Western channel to lower harbor. Access to new terminal on

Georgetown Harbor
Bottom Sediments Analysis
received in lab April 5, 1971

Date: August 31, 1971 **EPA, REGION III, TECHNICAL SUPPORT LABORATORY DATA SHEET #** 1 of 2

Lab No	Sample No	Date Sampled	Time	Gamma Activity pCi/gm	% Total Volatile Solids	COD mg/g	TKN mg/g	NH_3-N mg/g	Oil & Grease mg/g	Total P mg/g	Pb µg/g	Zn µg/g	Cu µg/g	Cr µg/g	Merphos µg/kg	DEF µg/kg
				←					Dry Basis							→
71-347	EC - 1	4-1-71	1205		1.9	3.8	0.1		76.3	0.2	5	77	4	4		
71-348	SIB - 1	"	1225		1.1	3.4	< 0.1		11.6	0.6	6	12	5	4		
71-349	BC - 1	"	1240		3.8	12	0.6		19.2	0.5	21	25	17	7		
71-350	RE - 1	"	1315		3.9	16	0.6		94	0.4	10	30	13	13		
71-351	RE - 2	"	1330		7.1	5.7	0.2	< 0.01	68	0.1	5	19	4	6		
71-352	RE -3	"	1345		7.2	55	1.2		984	0.7	13	120	12	33		
71-353	FPB - 1	"	1355		16	130	3.5	0.35	836	1.1	68	250	25	72		
71-354	RIC - 1	"	1405		14	110	2.9		80	0.3	48	220	20	65		
71-355	SPC - 1	"	1450		15	130	3.3		2110	0.5	46	130	14	71		
71-356	SPC - 2	4/2/71	0805		18	160	3.1		1420	0.2	40	360	760	56		
71-357	NBSR - 1	"	0815		17	160	3.4		4820	1.4	1100	9100	65	110		
71-358	NBSR - 2	4/1/71	-		17	160	3.7		1200	1.4	900	6300	60	100		
71-359	NBSR - 3	"	1500		15	120	3.2		965	1.1	62	150	48	62		
71-360	TBSR - 1	4/2/71	0830		16	160	2.8		1720	1.2	88	210	29	96		
71-361	TBSR - 2	"	0840		2.5	34	0.1	0.0	1800	0.5	32	98	16	22		
71-362	SR - 1	"	0855		12	170	2.2		3010	0.7	58	320	62	21		
71-363	SR - 2	"	0900		4.2	48	0.9		220	< 0.1	25	45	8	21		

Georgetown Harbor
Bottom Sediments Analysis
received in lab April 5, 1971

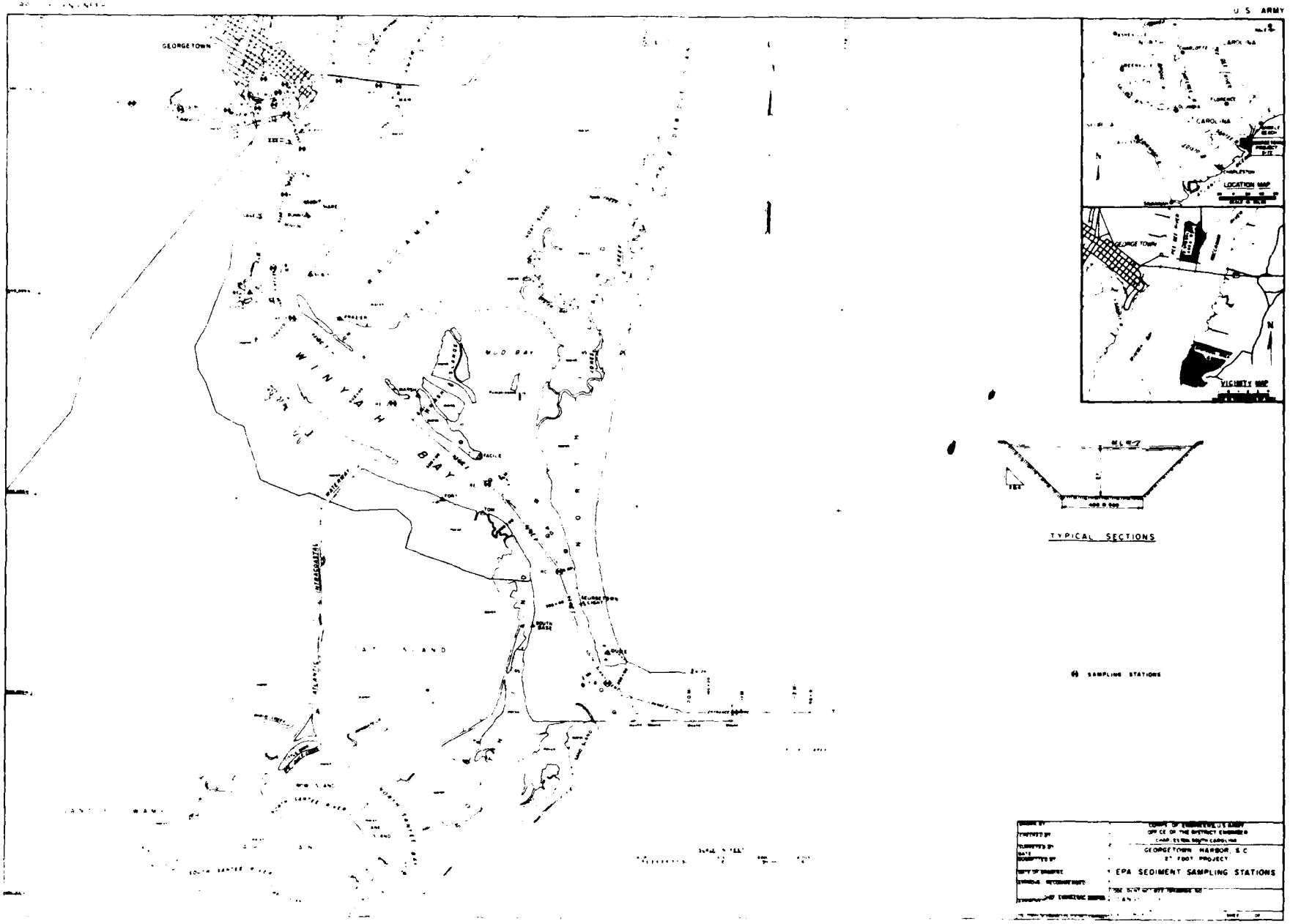
Date August 31, 1971 EPA, REGION III, TECHNICAL SUPPORT LABORATORY DATA SHEET #2 of 2

Lab No.	Sample No.	Date Sampled	Time	Activity pCi/gm	Volatile Solids	COD mg/g	TKN mg/g	NH3-N mg/g	Grease mg/g	Total P mg/g	Pb µg/g	Zn µg/g	Cu µg/g	Cr µg/g	Merphos µg/kg	DEI . µg/kg
				←				Dry Basis								→
71-364	SR - 3	4-2-71	0915		0.5	6.6	0.0		749	0.1	7	50	17	6		
71-365	SR - 4	"	0930		0.9	11	< 0.1		142	0.1	12	44	4	11		
71-366	PDR - 1	4/1/71	1440		0.9	9.3	0.0		188	< 0.1	21	52	6	10		
71-367	WR - 1	"	1420		0.2	1.6	0.1		244	< 0.1	8	15	3	49		

EPA Limits for Open Water Disposal

Sediments in Fresh and Marine Waters	Conc. % (dry wt. basis)
Volatile Solids	6.0
Chemical Oxygen Demand (C.O.D.)	5.0
Total Kjeldahl Nitrogen	0.10
Oil-Grease	0.15
Mercury	0.0001
Lead	0.005
Zinc	0.005

U.S. ARMY


GEORGETOWN
WINYAH BAY
MUD BAY
SAMPLING STATIONS
LOCATION MAP
VICINITY MAP
TYPICAL SECTIONS
GEORGETOWN HARBOR, S.C.
EPA SEDIMENT SAMPLING STATIONS

DEPARTMENT OF THE ARMY, SOUTH ATLANTIC DIVISION LABORATORY,
CORPS OF ENGINEERS, 611 SOUTH COBB DR.,MARIETTA, GA. 30061

Description: Sediment Samples
Date Received: 20 Apr 1977
Date Reported: 10 Jun 1977
Tested For: Chemical Analysis (see below)
Lab. No: See Below

District: Charleston
Project: Georgetown Harbor Navigation Project
W. O. No. 0545
Reqn. No. SACEC-77-33

	Percent by Weight (Dry Basis)											
Lab. No.	3S-485*	3S-486*	3S-487*	3S-488*	3S-489*	3S-490*	3S-491*	3S-492*	3S-493*	3S-494*	3S-495*	3S-496*
Field Sample No.	GH 1**	GH 2	GH 3	GH 4	GH 5	GH 6	GH 7	GH 8	GH 9	GH 10	GH 11	GH 12
Volatile Solids		0.35	0.30	17.15	13.37	14.51	11.48	13.88	16.65	16.28	16.02	0.52
T. V. S. Formula EC		1.47	1.47	22.16	13.93	15.22	11.02	13.34	18.38	18.35	15.87	2.00
Total Organic Carbon		<0.10	<0.10	6.01	3.05	3.05	3.06	3.99	6.40	5.88	5.59	0.26
C. O. D.		0.15	0.16	21.27	12.87	14.18	9.90	12.27	17.41	17.38	14.73	0.69
Nitrogen, Kjeldahl		0.018	0.003	0.370	0.330	0.345	0.270	0.283	0.412	0.422	0.413	0.023
Oil and Grease		0.027	0.023	0.198	0.146	0.210	0.109	0.190	0.328	0.234	0.062	0.001
Lead		<0.0005	<0.0005	0.0024	0.0029	0.0025	0.0026	0.0078	0.0062	0.0074	0.0031	<0.0005
Zinc		0.0007	0.0008	0.0080	0.0054	0.0075	0.0060	0.0067	0.0200	0.0280	0.0095	0.0004
Mercury		0.00003	0.00002	0.00011	0.00010	0.00017	0.00006	0.00010	0.00014	0.00006	0.00014	0.00002
Total Phosphorus as PO_4		0.025	0.064	0.531	0.574	0.559	0.384	0.510	0.688	0.620	0.704	0.026
Iron		0.150	0.150	2.9	2.6	3.2	3.1	2.9	3.9	3.9	3.8	0.055
Cadmium		<0.00005	0.00005	0.00005	<0.00005	0.00005	<0.00005	<0.00005	0.00006	0.00009	0.00005	<0.00005
Arsenic		0.00010	0.00012	0.00039	0.00022	0.00025	0.00024	0.00024	0.00039	0.00034	0.00037	<0.00005
Chromium		0.0005	0.0005	0.0042	0.0037	0.0033	0.0036	0.0039	0.0048	0.0036	0.0045	<0.0005
Nickel		<0.0005	<0.0005	0.0020	0.0025	0.0023	0.0023	0.0016	0.0021	0.0025	0.0021	<0.0005
Copper		0.00005	0.00010	0.00052	0.00060	0.00072	0.00070	0.00040	0.00066	0.00108	0.00060	<0.00005
Beryllium		<0.00005	<0.00005	0.00008	0.00010	0.00008	0.00008	0.00008	0.00008	0.00012	0.00012	<0.00005
Selenium		<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Vanadium		<0.0005	0.0005	0.0055	0.0045	0.0055	0.0055	0.0045	0.0055	0.0014	0.0065	<0.0005

*Gradation curves reported on ENG Form 2087.
**Sample composed of large shells; insufficient sediment for testing.

Tested By: JN, HM
Checked By: DW

U. S. ARMY ENGINEER DIVISION LABORATORY, SOUTH ATLANTIC
CORPS OF ENGINEERS
MARIETTA, GEORGIA

DISTRICT: Charleston
PROJECT: Georgetown Harbor
CONTRACT NO.: ---

GENERAL TEST REPORT
(STANDARD ELUTRIATE TEST)

DATE REPORTED: 14 June 1977
WORK ORDER NO.: 0562
REQN. NO.: SACEC-77-38
BASE UNIT COST: ---
DATE SAMPLE RECEIVED: 4-20-77
LAB NO.: See Below

DESCRIPTION: Sediment and Water
SOURCE:
FOR USE AS:
TESTED FOR: Chemical Analysis (See below)

☐ MEETS SPECIFICATIONS N/A ☐ FAILS SPECIFICATIONS (See below)

Lab. No. / Field Sample No.		3E-483 Receiving Water Disposal Site	3E-484 Elutriate GHE 1 & GHE 2 (Combined)
Total Organic Carbon	mg/l	15	36
Nitrogen, Ammonia	"	0.12	18.00
Nitrogen, Kjeldahl	"	0.25	19.60
Oil and Grease	"	0.0	0.5
Total Phosphorus as P	"	0.035	0.130
Ortho Phosphorus as P	"	0.001	0.025
Lead	ug/l	7.5	6.0
Zinc	"	23	23
Mercury	"	< 0.5	< 0.5
Iron	"	1	31
Cadmium	"	1.3	4.6
Arsenic	"	< 5.0	10
Chromium	"	< 5	≤ 5
Nickel	"	5.0	4.0
Copper	"	1.8	1.4
Beryllium	"	< 0.25	< 0.25
Selenium	"	< 5.0	< 5.0

REMARKS:

REPORTED BY: PHONE WIRE
DATE

TESTED BY: KB, JN, DW
CHECKED BY: DW
SAMPLED BY:

SAD FORM 158-R
10 OCT 73

Previous editions of this form are obsolete.

Standard Elutriate Test
Description: Sediment and Water
Date Sample Received: See Below
Date Reported: 15 June 1977

DEPARTMENT OF THE ARMY, SOUTH ATLANTIC DIVISION LABORATORY,
CORPS OF ENGINEERS, 611 SOUTH COBB DR.,MARIETTA, GA. 30061

Tested For: Chemical Analysis (see below)

District: Charleston
Project: Georgetown Harbor,SC
Reqn. No. SACEC-77-44 & Ch. 1
Work Order No. 0609

Lab. No.		3E-608A	3E-608B	3E-609A	3E-609B	3E-655	3E-656	3E-657	3E-658
Field Sample No.		Receiving Water Disposal Site	Elutriate GHE 5	Receiving Water Disposal Site	Elutriate GHE 6	Receiving Water Disposal Site	Elutriate GHE 3 and GHE 4 Combined	Receiving Water Disposal Site	Elutriate GHE 7
Date Received:		5-11-77	5-11-77	5-11-77	5-11-77	5-19-77	5-19-77	5-24-77	5-24-77
Total Organic Carbon	mg/l	14	10	12	9	11	17	8	9
Nitrogen, Ammonia	"	0.08	0.63	0.10	2.80	0.27	7.95	0.10	0.14
Nitrogen, Kjeldahl	"	0.28	1.28	0.30	3.18	0.56	8.79	0.33	0.37
Oil and Grease	"	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Phosphorus as P	"	0.040	0.025	0.035	0.025	0.035	0.035	0.035	0.050
Ortho Phosphorus as P	"	0.015	0.005	0.010	0.005	0.015	0.010	0.010	0.015
Lead	ug/l	6.0	5.5	5.5	5.0	5.0	5.0	5.0	6.0
Zinc	"	17	18	18	16	10	17	15	6
Mercury	"	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Iron	"	9	168	15	9	31	448	3	184
Cadmium	"	2.5	1.7	0.6	1.3	1.6	1.8	1.0	2.8
Arsenic	"	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Chromium	"	<5	<5	<5	<5	<5	<5	<5	<5
Nickel	"	3.0	5.0	4.0	4.0	3.0	5.0	3.5	4.0
Copper	"	1.4	1.5	2.4	1.3	1.3	2.4	1.2	1.7
Beryllium	"	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	0.25
Selenium	"	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0

Tested By: KB, JN, DW
Checked By: DW

APPENDIX B

SOIL ASSOCIATIONS IN THE STUDY AREA

2.04 Soils. Soil associations found in the area around Georgetown Harbor are quite varied. The major associations are as follows:

2.04.1 Capers Association: These soils are found on South Island, Cat Island, the North Island tidal marsh and the brackish marsh boundary of Waccamaw Neck. Capers soils have very dark grayish-brown to dark gray silt loam to clay surface layers and gray to greenish-gray silt clay loam to clay subsoils and contain a high percentage of organic material.

2.04.2 Lynchburg-Coxville Association: These soils are found in the extreme northwest part of the project area in the vicinity of Georgetown. Lynchburg soils are somewhat poorly drained and have gray to dark gray loamy sand surface layers and mottled pale yellow and gray clay loam subsoils. Coxville soils are poorly drained and are found on broad nearly level or depressed areas. They have dark gray to very dark gray sandy loam or loam surface layers and gray sandy clay subsoils with strong brown and red mottles.

2.04.3 Troup-Wagram-Rutledge Association: These soils are located on the western side of Winyah Bay, northwest of the Atlantic Intracoastal Waterway. These are deep, well-drained to very poorly drained, gently sloping and nearly level soils. Troup soils have grayish-brown sandy surface layers over 40 inches thick and yellowish-brown to red sandy loam to sandy clay loam subsoils. Wagram soils have grayish-brown loamy sand surface layers 20 to 40 inches thick and yellowish-brown sandy clay loam subsoils. Troup and Wagram are well to excessively drained. Rutledge soils are very poorly drained and occupy the lowest drainage position. They have black sand or loamy sand surface layers over 10 inches thick and gray sandy subsoils.

2.04.4 Wando-Coastal Beach Association: These soils are found only on North Island and are deep, excessively to well-drained, gently sloping to nearly level soils. Wando soils are excessively drained and occupy a long narrow strip of land paralleling the coast just behind the sand dunes along the beaches. They have dark grayish-brown fine sand surface layers and strong brown fine sand subsoils. Coastal beach consists of sands and sand dunes occupying a narrow strip of land bordering the Atlantic Ocean.

2.04.5 Lakeland-Chipley Association: These soils occur in a narrow area adjacent to the Capers Association on Waccamaw Neck. These are deep, excessively and moderately well-drained, gently sloping and nearly level soils. Lakeland soils are excessively drained and have grayish-brown loose sand surface layers and yellowish-brown to red sand subsoils. Chipley soils are moderately well-drained and have grayish-brown or dark gray sandy surface layers and pale yellow or yellowish-brown sand or loamy sand subsoils.

2.04.6 Leon-Rutledge Association: These soils are located on the highest parts of Cat Island, Waccamaw Neck and the mainland near the Atlantic Intracoastal Waterway. This association consists of deep, somewhat poorly and very poorly drained nearly level soils. Leon soils are somewhat poorly drained and have dark gray to black sandy surface layers less than 10 inches thick and black to dark brown slightly cemented sandy subsoils. Below this is light gray to brown sand. Rutledge soils occupy the very poorly drained positions. They have black sand or loamy sand surface layers over 10 inches thick and gray sandy subsoils.

APPENDIX C

CONSIDERATION OF ITEMS LISTED IN SECTION 122 OF P.L. 91-611

The following items are specifically listed in Section 122 of Public Law 91-611. They are included here separately as an appendix, not because they are necessarily significant, but to demonstrate that they were considered in the impact assessment process.

1. Noise

a. Retain the existing 27-foot channel. No significant increase in noise levels. No shift in location of existing noise or increase due to secondary growth.

b. Deepen to 35 feet to Georgetown. No significant increase in noise levels due to dredging, although more dredging is required (see Table 1). Blasting of rock to deepen the upper channel would be audible to wildlife and residents of the area. Some increase in noise levels is possible if the facility should attract new industry to the area of the terminal.

c. Western channel in lower terminal. No significant change in noise levels due to dredging, although total dredging over a 50-year period is less than with existing project (see Table 1). Noise levels in vicinity of new terminal site can be expected to increase significantly over the very low levels now present, if a large number of supporting facilities are built and a great deal of secondary growth occurs. The amount of increase cannot be forecast without information on the type of secondary growth, where it would be located and its size.

2. Displacement of people.

a. Retain existing 27-foot channel. No persons would be displaced as a result of this alternative. New upland sites for disposal of dredged material would have to be acquired over the life of the project by the local sponsor. These new sites may require the acquisition of private lands by the local sponsor.

b. Deepen to 35 feet to Georgetown. No persons would be displaced as a result of the dredging required for this alternative. Acquisition of upland sites for disposal would be similar to that for the existing project, but significantly more acreage would be required for this alternative (see Table 1).

c. Western channel to lower harbor. No persons would be displaced as a result of dredging. Acquisition of upland sites for disposal would be similar to alternative A, but would be less over a 50-year period. Land for a terminal facility and access to the facility would have to be acquired by the local sponsor from private landholders. Other secondary growth would, presumably, be by private industry, and the land would be sold with the consent of the land owners.

3. Aesthetic values.

a. Retain existing 27-foot channel. Aesthetic values would continue to be periodically altered by the placement of dredged materials on upland sites.

b. Deepen to 35 feet to Georgetown. Disposal areas required for this alternative greatly exceed those required for the existing project. New industry might be attracted to the project area, which might be aesthetically unpleasing to some persons. Most new industry would probably locate in areas already zoned for this purpose.

c. Western channel in lower harbor. An additional large acreage would be required for the disposal of dredged material for new construction but would be less than for the existing project over a 50-year period. New terminal facilities and secondary growth of an industrial or commercial type would be aesthetically unpleasing in comparison to the existing rural area, which is forest and wetlands with light housing and some large holdings of historic interest (see Plate 5).

4. Community cohesion.

a. Retain existing 27-foot project. Project would continue to provide employment and business activity which aids in community cohesion (see items 8, 11, and 12).

b. Deepen to 35 feet to Georgetown. See items 8, 11, and 12 as they relate to community cohesion. This alternative would provide more employment than alternative A and a more competitive port with the expected changes in shipping.

c. Western channel in lower harbor. See items 8, 11, and 12 as they relate to community cohesion. This alternative would provide more employment than alternative A and a more competitive port, but could result in the movement of certain businesses from the present business center in Georgetown to the lower harbor area.

5. (Desirable) community growth.

a. Retain existing 27-foot project. No change in growth anticipated.

b. Deepen 35 feet to Georgetown. Growth could be expected as a result of industry attracted by a deeper port and related secondary development. Most of the growth would occur in areas zoned for this purpose.

c. Western channel in lower harbor. Growth could be expected due to the deeper harbor, but much of this growth could occur in areas not desired by regional planners and the local residents affected. The area is presently zoned for Forestry-Agriculture and Conservation-Preservation.

6. Tax revenues (local government).

a. Retain existing 27-foot project. Revenues generated by the existing channel would continue to be collected, and local government funds would continue to be spent for public services.

b. Deepen 35 feet to Georgetown. Additional revenues might be generated by new industries or expansion of existing facilities. Any local expenses required to handle new or expanded facilities would represent a decrease in local funds. Since both the taxes collected and the funds expended by local governments would depend on the type of new industry, the number of additional persons attracted to work in the industry, and the size and location of the industry, no reasonable estimate can be made concerning net flow of local funds. Because of the strong interest by the local government in acquiring a deeper channel to Georgetown, it is assumed that the agencies involved anticipate the new flow of revenues to be positive.

c. Western channel in lower harbor. See 6.b. above concerning the general uncertainity of predicting net flow of local revenues due to secondary development. Because the western channel would require new facilities and improved access in a presently undeveloped area, the expenses incurred by local interests for this alternative would be greater than for the 35-foot channel to Georgetown. Some of these expenses would fall to private concerns, some to the State of South Carolina, and some to the local governments. These costs (for new or relocated terminal facilities) are not included in the benefit-cost ratio for the project.

7. Property values.

a. Retain existing 27-foot channel. No change is anticipated other than the gradual inflation of property values.

b. Deepen 35 feet to Georgetown. Certain properties in the vicinity of the terminal would likely increase in value as a result of their proximity to a deeper channel.

c. Western channel to lower harbor. Property values in the area of the new terminal that could be used for support facilities would probably increase. Property in the vicinity of the existing terminal would decrease in value according to its utility for a 12-foot channel as opposed to the existing 27-foot channel. Residential property in the vicinity of the new terminal or access features but which was not used commercially would decrease in value where a portion of the existing value is due to its isolation and natural setting.

8. Public facilities. No public facilities are provided by any of the alternatives, although any person may ship cargo through the State Ports Authority terminals.

9. Public services. No direct public services are provided by the alternatives, although the terminal benefits the general public through business, industry and jobs (see 11 and 12 below). Certain public services must be provided by the local governments to the project, such as improvement to roads, sewerage, garbage collection and schools for employees. As was described for expenditure of tax revenues in 6 above, the western channel would probably require the largest expense by local government for public service.

10. (Desirable) regional growth. Although the growth may be significant to the Georgetown area, none of the alternatives will cause significant changes to regional growth. Charleston, Wilmington, and Savannah will probably remain the major ports for the region.

11 & 12. Employment/labor force/business/industrial activity.

a. Retain existing 27-foot channel. The existing project would continue to provide employment as a result of shipping general cargo through the Ports Authority terminal and by continuing to service business and industry in the area.

b. Deepen 35 feet to Georgetown. New industry and secondary business growth would likely occur as a result of the deeper channel in an area where a railroad, highways and other supporting facilities are already provided. Additional employment would be provided.

c. Western channel to lower harbor. Over the long-term project period (50 years) the deeper channel would likely generate new industry and business which would provide additional employment to the area. The incentive to smaller industry to locate in the area would not be as great for the near future as with the 35-foot channel to Georgetown where support facilities and access already exist.

13. Displacement of farms. No farms would be displaced by any of the alternatives, although there is a chance that some disposal of dredged material may take place on agricultural lands. See Plates 1-A and 4-7. The area currently being considered for the location of a terminal for the western channel is previously used disposal area which has recently been used for pasture.

14. Man-made resources (environmental).

a. No major alteration of man-made resources. Some shallow, open water areas in Winyah Bay will be replaced with marsh at experimental sites where dredged material is specially placed for this purpose.

b. Deepen to 35 feet to Georgetown. No major alteration of man-made resources. Some experimental marsh building as described in A above.

c. Western channel to lower harbor. Access to new terminal on Estherville Plantation and secondary growth in the area could alter the residential property and historical setting of the area. Same experimental marsh building as described in a. above.

15. Natural resources. Resources that will be affected by all three alternatives are fully described in Section 2.0 and 4.0 of the EIS, and will be affected roughly in proportion to the amount of dredging required for each project (Table 1 of EIS). The common effects are short-term increase in turbidity and sedimentation, smothering of plant and animal communities in disposal sites, reduction of benthic populations in the path of the cutterhead and possible adverse effect on fish larvae due to turbidity. In addition to these common effects, location of a terminal near Estherville Plantation could result in loss of additional upland resources to be altered by industry and secondary growth.

16. Air pollution. Some contribution to the particulate problem will be made by all three alternatives as a result of secondary growth. Georgetown is an Air Quality Maintenance Area, and new facilities will have to be permitted by S. C. Department of Health and Environmental Control to assure that particulate standards are met. A proportionately greater effect would be felt due to secondary growth in the Estherville area where little development now exists.

17. Water.

a. A short-term increase in turbidity and sedimentation and a possible lowering of water quality due to disturbance of chemicals or anoxic materials by the cutterhead would occur with continued maintenance of the existing project as well as with the two deepening alternatives - roughly in proportion to dredging required (see Table 1 and Plate 1).

b. Deepen 35 feet to Georgetown. Some increase is anticipated in point source and surface runoff pollution as a result of new industry which would likely be attracted to the general area of the existing terminal and Sampit River. The likelihood of spills or shipping accidents would be increased with the larger vessels and increase in shipping volume.

c. Western channel in lower harbor. The possibility of point source discharges, surface runoff, spills or accidents would be similar to the alternatives described above; however, the impact would be greater for the Estherville area, which is presently undeveloped and highly valued for its surrounding natural areas.

APPENDIX D

ITEMS CONSIDERED IN EVALUATION OF IMPACTS INVOLVED IN THE DISCHARGE OF DREDGED OR FILL MATERIAL IN NAVIGABLE WATERS

EVALUATION OF FACTORS INVOLVED IN THE DISCHARGE OF DREDGED OR FILL MATERIAL IN NAVIGABLE WATERS. CRITERIA FROM 40 CFR 230.

Paragraph	Criteria	Plan A	Plan B	Plan C
230.4-1(a)	PHYSICAL EFFECTS			
230.4-1(a)(1)	Wetlands	No wetlands will be affected by the continued maintenance of the existing project. Future disposal sites will be upland areas or open water. (1.08 and 1.09 of EIS)	Same as Plan A with regard to disposal areas. A very small fringe of fresh water marsh on south side of Sampit River above Hwy. 17 would be lost if related plans by the City of Georgetown to develope the area were carried out. Not a significant area. (Plate 5 of EIS)	Same as Plan A with regard to disposal areas. A small fringe (20 feet wide) of marsh adjacent to the previous disposal area would be destroyed in the construction of a new terminal. Mostly high marsh species. Not significant. (Plate 5 of EIS)
230.4-1(a)(2)	Water Column	Short-term increase in turbidity and sedimentation due to dredging. Temporary reduction of phytoplankton and zooplankton, and possible adverse effect on fish larvae due to increased turbidity (4.02 of EIS). Outfall from diked disposal areas will be monitored to assure compliance with applicable turbidity regulations.	Short-term increase in turbidity similar to that described for Plan A. but significantly more dredging required (Table 1, EIS). Some increase in erosion, turbidity and sedimentation due to secondary growth near Georgetown. (4.03.4.3 of EIS)	Short-term increase in turbidity similar to that described for Plan A. Less dredging required over 50 years. Some increase in erosion, turbidity, and sedimentation due to construction of terminal, access, and secondary growth in a presently undeveloped area. (4.03.4.4)
230.4-1(a)(3)	Benthos	Smothering of plant and animal communities and replacement with more productive marsh in 45 acre experimental area. Periodic destruction of benthic organisms in path of the cutterhead (1.09.1 and 4.02.1.4 of EIS)	Smothering of plant and animal communities and replacement with more productive marsh in experimental area. More dredging required more often than Plan A. More frequent destruction or disturbance of benthic organisms by cutterhead. (Table 1, EIS)	Smothering of plant and animal communities and replacement with more productive marsh in experimental areas. Dredging of new western channel would result in destruction or disturbance of benthic organisms not now affected by dredging. Less dredging over 50-year period than Plan A. (Plate 1 and Table 1, EIS)
230.4-1(b)	Chemical-Biological Interactive Effects			
230.4-1(b)(1)	Exclusion Criteria	Predominantly sandy material removed by hopper dredge in the lower harbor is deposited in ocean disposal sites and is not evaluated under Section 404; however, the material is exempt from evaluative procedures under paragraph 230.4-1 (b)(1)(i), should it ever be used as fill or otherwise be used in a manner which requires 404 evaluation. (1.08.3, EIS)	The same exclusion criteria would apply to sandy material as was described for Plan A.	The same exclusion criteria would apply to sandy material as was described for Plan A.

EVALUATION OF FACTORS INVOLVED IN THE DISCHARGE OF DREDGED OR FILL MATERIAL IN NAVIGABLE WATERS. CRITERIA FROM 40 CFR 230.
(continued)

Paragraph	Criteria	Plan A	Plan B	Plan C
230.4-1(b)(2)	Water Column Effects	No adverse impact from heavy metals based on elutriate tests. No visible surface films from oil and grease. Increase in nutrient levels, oxygen demand and volitile solids next to dredge, but no significant, widespread impacts.	This alternative involves considerably more dredging of material from the upper harbor than does Plan A or Plan B.	This alternative involves the least amount of dredging of material from the upper harbor.
230.4-1(b)(3)	Effect on Benthos	Chemical-biological interactive effects due to dredging and disposal not significant.	Chemical-biological interactive effects due to dredging and disposal not significant.	Chemical-biological interactive effects due to dredging and disposal not significant.
230.4-1(c)	Comparison of Sites	The only navigable waters receiving large quantities of dredged material is the 45 acre marsh building site. Other disposal sites anticipated for use in the near future are either previously used diked areas, new upland sites, or ocean disposal for predominantly sandy material. These sites represent the least disruptive alternatives. Detailed comparisons of sediments and community structure were not determined necessary. (1.08-1.09.5 and Table 1 of EIS)	The same type of disposal sites would be used for this alternative as for Plan A, except more acreage would be required. Because of the type of sites, detailed studies of sediments and community structure were not determined necessary.	The same type of disposal sites would be used for this alternative as for Plan A, except fewer acres would be required over a 50-year period. Detailed studies of sediments and community structure not required.
230.4-2	Water Quality	The continued maintenance dredging of the existing channel would not cause a violation of any legally applicable water quality standards established in 40 CFR 230 or the Water Classification Standards System for the State of South Carolina.	More dredging with this alternative and greater impact on water quality; however, no violation of legally applicable water quality standards can be predicted. Supporting facilities and secondary growth which might occur after completion of the channel would have to be permitted by the South Carolina Department of Health and Environmental Control, which, along with EPA, would be responsible for assuring that the new facilities would not violate water quality standards.	No violation of legally applicable water quality standards can be predicted as a result of dredging for this alternative. If a great deal of discharge should occur in this presently undeveloped area, water quality could be degraded. The South Carolina Department of Health and Environmental Control and EPA would be responsible for assuring that new facilities would not violate water quality standards.

EVALUATION OF FACTORS INVOLVED IN THE DISCHARGE OF DREDGED OR FILL MATERIAL IN NAVIGABLE WATERS. CRITERIA FROM 40 CFR 230.
(continued)

Paragraph	Criteria	Plan A	Plan B	Plan C
230.5	SELECTION OF DISPOSAL SITES			
230.5(a)	Need for the Proposed Activity	Continued maintenance dredging would be necessary to achieve the benefits of a 27-foot channel to the ocean. Barging or shipment by rail of all cargo from other deep ports would be possible but would be more expensive.	A deeper channel would be needed to handle the larger vessels now being used and anticipated. A shallower channel or no channel for ocean shipping is possible, but the benefits due to shipping by large vessels would be forgone. This alternative would accommodate the deeper vessels, but initial costs and maintenance would exceed the anticipated benefits.	This alternative would allow the deeper vessels to unload in Winyah Bay. First costs and maintenance costs of the channel are less than the anticipated benefits. Additional investment would be required by local interests for construction of a terminal, access and support facilities.
230.5(a)	Alternative Disposal Sites and Methods of Disposal	Of the many methods of disposal and possible disposal sites, the conclusion reached by the District Engineer, EPA, and other environmental agencies is that continued use of existing disposal sites is the least disturbing alternative followed by upland sites. Ocean disposal of additional material or other experimental methods will be adopted when the equipment becomes available and the experimental methods are shown to be preferable to existing methods.	Disposal site locations and methods of disposal for this alternative are similar to Plan A, except that the amount of dredging is much greater with this alternative.	Disposal site locations and methods of disposal for this alternative are similar to Plan A. Over a 50-year period the amount of dredging would be less than with the existing project.
230.5(b)	Degradation of Water Uses at Proposed Disposal Sites			
230.5(b)(1)	Municipal Water Supply	No intakes near proposed disposal sites.	No intakes near proposed disposal sites.	No intakes near proposed disposal sites.
230.5(b)(2)	Shellfish	None of the disposal sites should have a significant impact on shellfish. The 45-acre site for a marsh building experiment is the only open water site. It is not an area of high concentration and, like the rest of Winyah Bay, is closed to shellfish harvesting. The area was chosen in accord with State and Federal agencies responsible for fish and wildlife protection. Curtains are used to reduce transport of sediment to any areas where shellfish might occur.	Impact of shellfish similar to that described for Plan A, except that more dredging is required for this alternative. (Table 1, EIS)	Impact on shellfish similar to that described for Plan A, except that more dredging is required for this alternative.

EVALUATION OF FACTORS INVOLVED IN THE DISCHARGE OF DREDGED OR FILL MATERIAL IN NAVIGABLE WATERS. CRITERIA FROM 40 CFR 230.
(continued)

Paragraph	Criteria	Plan A	Plan B	Plan C
230.5(b)(3)	Fisheries	Forty-five acres of open water in Winyah Bay will receive dredged material to an elevation where Spartina marsh can be established. Where marsh becomes established, the resultant productivity will be greater than for the open area. No significant spawning or nursery areas will be used as disposal sites.	Similar to Plan A.	Similar to Plan A.
230.5(b)(4)	Wildlife	Continued use of existing disposal areas and the experimental marsh building would not have significant effects on wildlife. Upland disposal areas would likely be pine or mixed pine-hardwood forest (the most common classification in the project area and surrounding regional area). Use as a disposal area would temporarily restrict its use as wildlife habitat. After the area has been filled to capacity, it can resume its present cycle of growth and cutting.	Similar to Plan A, except that more upland disposal area would be required (Table 1, EIS).	Similar to Plan A. Large amount of disposal area needed for initial construction, but less disposal with this alternative over 50-year period than with Plan A.
230.5(b)(5)	Recreation	No disposal sites or methods of discharge related to dredging would result in reduction or alteration of recreational activities.	Same as Plan A.	Same as Plan A.
230.5(b)(6)	Threatened or Endangered Species	Continued use of existing disposal sites and marsh-building would not destroy or modify critical habitat for endangered species. Upland disposal sites would be chosen with State and Federal agencies responsible for protection of threatened and endangered species. Critical habitat for red-cockaded woodpecker and other possible inhabitants would be avoided.	Similar to Plan A, except that more upland areas would be required for this alternative (Table 1, EIS).	Similar to Plan A. Large amount of disposal area required for initial construction, but less disposal with this alternative over 50-year period than with Plan A.

EVALUATION OF FACTORS INVOLVED IN THE DISCHARGE OF DREDGED OR FILL MATERIAL IN NAVIGABLE WATERS. CRITERIA FROM 40 CFR 230.
(continued)

Paragraph	Criteria	Plan A	Plan B	Plan C
230.5(b)(7)	Benthic Life	Only disposal in navigable waters affecting benthos is marsh building site where existing bottom is not exceptionally productive. To be replaced with more productive marsh.	Same as Plan A.	Same as Plan A.
230.5(b)(8)	Wetlands	No disposal in wetlands is anticipated for continued maintenance of existing project. Future disposal sites will be upland areas or open areas. This is the least environmentally damaging course of action.	No disposal in wetlands is anticipated for initial construction or maintenance of this alternative.	No disposal in wetlands is anticipated for initial construction or maintenance of this alternative. A very thin strip of marsh (20 feet or less in width) in the vicinity of the proposed terminal would be destroyed in the construction of docking facilities. This strip is mostly high marsh. No known permanent, unacceptable disruption to beneficial water quality uses of the aquatic ecosystem as a result of disposal of dredged or fill material. Secondary growth, if not properly controlled, could adversely affect adjacent wetlands.
230.5(b)(9)	Submerged Vegetation	No submerged vegetation affected by this alternative.	No submerged vegetation affected by this alternative.	No submerged vegetation affected by this alternative.
230.5(b)(10)	Size of Disposal Site	Disposal sites are confined to minimum practicable size. Existing sites would be filled to maximum capacity; upland sites are anticipated for future sites.	Existing sites would be filled to maximum capacity; upland sites are anticipated for new areas. More upland sites would be required for this alternative.	Existing sites would be filled to maximum capacity; upland sites are anticipated for new areas. Large initial area required for construction. Less area required over 50 years than for Plan A.
230.5(c)	Other Factors Considered to Minimize Adverse Impacts	Appropriate scientific literature was consulted and various methods of disposal were considered. (Sections 1.08.1-1.09.5, EIS)	Appropriate scientific literature was consulted and various methods of disposal were considered. (Sections 1.08.1-1.09.5, EIS)	Appropriate scientific literature was consulted and various methods of disposal were considered. (Sections 1.08.1-1.09.5, EIS)
230.5(d)	Mixing Zone	Mixing zone held to minimum by turbidity curtains in only case of open water disposal (marsh-building site). Sampling around dredge and outfalls to determine compliance with standards. (Sections 1.09.1, 4.02.1.1, and Appendix A, EIS)	Same as for Plan A.	Same as for Plan A.

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